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PRODUCTIVITY, PRICES AND DISTRIBUTION IN SELECTED BRITISH INDUSTRIES

by

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AUTHOR'S PREFACE

This study presents the results of an exploratory investigation into variations of prices, costs and efficiency in different-sized firms in British industry in 1935. Such a study was conceived as part of a larger investigation into the distribution of the product of British industry which was carried out at the National Institute of Economic and Social Research in the years 1942–46. It was felt however that a study of inter-firm variations of prices and costs is both important and self-contained enough to stand on its own feet, and that it should be published as a separate paper. In order to make this inter-firm analysis, which is dealt with in Parts I and II of the present work, more understandable, it has been supplemented by information relating to the structure and organization of the trades analysed and by a time analysis of the cost structure of these trades in the 1907–37 period: this is given in Part III. It is hoped that further results of the long-term investigation mentioned above will be published in the near future; in particular, a Statistical Source Book based on the extensive collections and analyses that have been completed.

The data on which the inter-firm analysis has been based were compiled from unpublished material collected for the Fifth Census of Production. A special tabulation of these data was made for purposes of this investigation by the Statistics Division of the Board of Trade. Unfortunately it was not possible to obtain the data from the Board of Trade in such detail as we could have wished, owing to the necessity of avoiding possible disclosure of information relating to individual firms. I wish to express both my gratitude and that of the Institute for the great help which the Statistics Division of the Board of Trade has given us in the preparation of this study.

All the data in this book relate to pre-war years only, and the inter-firm analysis relates to 1935, when the last complete Census of Production was taken. This is regrettable and will reduce the interest of the work for those seeking up-to-date information on the structure of British industry. But it is hoped that the investigation will still be of some value to the more specialized reader. After all, the inter-relationships between costs and size, efficiency and size, etc.—which are the main subjects of this paper—will probably not change substantially even if the background of the industries against which we view such interrelationships has shifted. Admittedly, this will not apply when changes are as radical as they have been, for example, in the tin-plate industry. Neither is the methodological purpose of the work affected by the time factor. In fact, once the new and more appropriate data are collected as is now planned for future Censuses of Production, it will be very easy indeed to repeat and enlarge the investigation of inter-firm variations.

Throughout this investigation I have had the benefit of an advisory committee, consisting of Mr N. Kaldor (Chairman), Mr W. B. Reddaway, Mrs Joan Robinson and Mr J. R. N. Stone. Both in formulating the problems set for my investigations (as described in Chapter 1) and in analysing the material I have had the very active participation of the committee in the work of the inquiry, and I wish to express my gratitude for their generous help. In spite of heavy commitments of duties throughout the war years they always found time to come to frequent meetings and to discuss the problems of the work in progress. They have an essential share in any merit that this work may have, but they must not be held responsible for shortcomings in detail.

I also want to thank Mrs F. S. Stone, the Secretary of the Institute, for her constant interest and great assistance in all stages of my inquiry.

I am much indebted to Miss H. M. Rogers, Librarian at the Institute, for her very careful reading and correcting of the proofs.

Lastly I wish to add that this study was completed in 1946, before I accepted a post in the Civil Service.

L. ROSTAS

LONDON
July, 1947

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PART I

CHAPTER I

GENERAL INTRODUCTION

1. NATURE OF THE INVESTIGATION INTO THE DISTRIBUTION OF THE PRODUCT OF INDUSTRY

The special investigation into the cost structure of selected industries in Britain, presented in this study, forms part of a larger investigation into the distribution of the product of industry which was initiated by the National Institute of Economic and Social Research in 1942. The purpose of this larger inquiry is to discover the structure of prices, the relations of different elements of costs and, in particular, the ratio of the selling value of output to the prime costs of production in the different branches of industry and of their movement through time. As such, it is primarily a fact-finding inquiry and is intended to throw light on certain aspects of the structure of British industry not hitherto analysed. The ultimate purpose which the investigators have in mind, however, is not merely the discovery of facts, but the theoretical interpretation and analysis of the material collected, in the hope of throwing some light upon certain questions of great theoretical and practical importance, i.e. on the validity of various hypotheses concerning the factors which determine prices and the distribution of the product of industry between wages and profits; and on the factors which influence the technical efficiency of industry. Even the larger investigation can by no means hope to settle these questions, but a study of the relation of prices and costs is regarded as a necessary preliminary to any successful advance in this field.

2. PROBLEM OF PRICES AND DISTRIBUTION

The need for more detailed empirical inquiries into the price structure became apparent when the new analysis of imperfect competition cast doubt on the validity of traditional explanations concerning the determination of prices. At the same time, the new theories have not succeeded in putting forward a single universal hypothesis of how prices are determined; rather, they left open a number of alternative possibilities, the validity of any of which could only be tested by extensive empirical studies. The following paragraphs merely intend to give a brief indication of the nature of the alternative hypotheses concerning price determination, at the present stage of economic theory.

The unsettled questions of value theory relate to the price policy of individual firms, where the term 'price policy' comprises all considerations which determine the relation of the selling price to the prime costs of production, per unit of output. (This difference between the selling price and the average prime cost will subsequently be referred to as the 'gross-profit margin' or 'gross margin'.) There is no dispute on the question that the intended or normal selling price of a product must always be sufficient to cover those costs which were directly incurred in the making of the product, i.e. the prime costs of production. Hence the problem relates only to the determination of that part of the price which is in excess of the average prime costs, and out of which the overhead costs, as well as the net profit of the producers, must be covered.

Theoretical analysis is often conducted on the assumption that firms always fix the gross-profit margin in such a way as to maximize their total gross profit, i.e. to maximize the difference between receipts and costs, where both are regarded as definite functions of the volume of sales. On this hypothesis the following cases can be distinguished:

(1) Many firms selling in a perfect market ('perfect competition'). Here each firm is assumed to take the ruling prices as given by the market, and (being faced with an unlimited market) to adjust its output and sales so that the marginal prime cost (the addition to its total cost caused by the last increment in production) is equated to the market price. Here the gross-profit margin is equal to the difference between the marginal and the average prime costs which in turn depends on the elasticity of prime costs with respect to output. The competition of newcomers, in an industry where entry is free, will in turn so adjust the price that the difference between the average and the marginal prime costs affords, to the typical firm, no more than the equivalent of the competitive rate of profit on its capital.

(2) Many firms selling in an imperfect market ('polypoly'). Here the market for the product of each individual firm is limited, and firms possess a certain freedom of fixing their selling price higher or lower, with corresponding variations in their sales. The gross-profit margin in this case is equal to the difference between the marginal and average prime costs, *plus* the difference between average and marginal receipts, and is thus dependent on both the elasticity of prime costs and the elasticity of demand.

(2*a*) The same as the previous case, but assuming that the cost conditions of the typical firm (owing to excess capacity) are such as to make the elasticity of prime costs practically infinite and thus the difference between marginal and average prime costs negligible. Here the gross-profit margin depends entirely on the elasticity of the demand function of the individual firm, which in turn depends on the degree of market imperfection (the cross-elasticities of demand for rival products), the number of firms, etc.

(3) A small number of firms selling in a perfect (or imperfect) market and pursuing independent policies without any collusion ('oligopoly'). Here each firm takes into account the reaction of its own price policy upon the policy of its rivals, and there is no uniquely determined demand function for the product of the firm. The theoretical determination of the gross-profit margin is only possible in cases where firms can be shown to divide themselves into price leaders and price followers, the price leader taking the initiative in fixing the price, the price followers acting as in cases (1) or (2). The gross-profit margin of the price leader in this case depends on the elasticity of market demand and the sales of the price followers.

(4) A small number of firms, but acting in collusion. This case approximates to

(5) Monopoly, where a single firm fixes the gross-profit margin with reference to the elasticity of demand for the market as a whole.

A strict adherence to the theoretical assumption that firms behave in such a manner as to maximize their profits with reference to clearly determined and known demand (and cost) functions is, however, unrealistic. Ignorance of their 'demand curves'—the mere postulate of which assumes knowledge of hypothetical situations to which the market mechanism gives few clues—ignorance of rivals' reactions, and the fear of potential competition, may deter firms from pursuing an 'active' price policy, i.e. from exploiting, or attempting to exploit, fully the element of monopoly power inherent in this situation. Even where monopoly rules, or a small group of firms fix prices in collusion, firms may fix their profit margins at a level considerably lower than that which would produce maximum profits in the given situation, either through fear of attracting new competition into their market, or from other motives, such as a desire to avoid public criticism or to acquire a reputation for fair dealing.

Two alternative hypotheses have been put forward as to the typical price policy of individual firms, which do not rest on the maximum-profit assumption. The first is that firms endeavour to fix a profit margin which is just sufficient to cover overhead costs and to provide a normal rate of profit on capital, *when equipment is worked at optimum capacity*. This may be described as the 'fair-price' policy. The second is that profit margins are to be explained as the outcome of historical factors, and not determined by any precise calculation of current costs or of current market conditions. Competition then takes the form of sales pressure of various kinds, rather than price cutting, so that where profit margins happen to be high (in relation to overhead costs at optimum capacity), overhead costs are pushed up both by surplus capacity being attracted into the industry, and by increased selling costs.

The difference between these two last hypotheses may be broadly expressed by saying that, on the first, overhead costs per unit of output determine profit margins, and on the second, profit margins themselves determine overhead costs (through the cost-raising influence of competition). In the second case, moreover, competition may also lead to the sharing of the market with relatively inefficient (high-cost) firms who live under the shelter afforded by the excessive profit margins of the low-cost firms.

Whatever view one may take as to the relevance of the considerations suggested by recent theoretical analysis in determining the price policies of firms, it is clear that in the actual world price determination may be more or less monopolistic, or more or less competitive, according to the extent to which actual profit margins exceed the level that would rule under perfect competition. The latter in turn may be defined as the gross-profit margin which is just adequate to cover genuinely indispensable overhead costs (i.e. it would exclude, for example, competitive advertising costs) and afford no more than the competitive rate of profit on the capital invested in the business, when the rate of production of the representative producer is at optimum capacity.*

Our investigation cannot hope by itself to answer the broad question of the quantitative importance of the monopolistic elements in price-fixing; still less, to verify or reject the particular hypotheses as to how prices are determined. Quite apart from the lack of theoretical criteria for answering such primary questions as to what constitutes a purely competitive rate of profit, it would, at present, be impossible to obtain detailed information on items like the capital invested in businesses, the actual rate of profit earned or the degree of utilization of capacity. Nevertheless, an investigation of how actual prices are 'made up' between the different elements of costs, and how the prices and costs of different firms of an industry are related to one another is a necessary first step; and even a restricted amount of information may suffice for making out a *prima facie* case for or against certain hypotheses in certain instances. Thus, in industries where the gross-profit margin is high (in relation to price or in relation to prime costs), the monopolistic factor might be more important than in cases where the gross margin is relatively low. In an industry where a large number of firms are selling a fairly homogeneous commodity at closely similar prices, and there is a fairly regular series of firms in ascending order of prime costs per unit, but where the differences in prime costs and profit margins (of the different firms) are not too large in relation to price, the picture is not inconsistent with the conditions we should expect in a more or less perfect competitive market. Where a few large firms with low prime costs and high profit margins co-exist with a fringe of high-cost firms, all selling at about the same price, it is plausible to suppose that there is some sort of collusion between the large firms, which prevents them from competing away the high margins and driving the high-cost producers out of business. But where there are a number of firms selling goods under a variety of trade names, and it appears that the highest margins are associated with the highest prime costs, competition is obviously far from perfect, and there is an *a priori* probability that the element of monopoly in pricing is relatively important.

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* Both overhead costs per unit of output, and the rate of profit on capital will vary, of course, with the degree of utilization of capacity. But since under-utilization of capacity is itself the result of monopolistic elements in the competitive system, the relevant costs must be calculated with reference to optimum-capacity working and not the actually utilized capacity.

Such conclusions are at best very tentative, and in the present study we do no more than set out the facts and leave the way open for further analysis and investigation.

A full analysis of the problem of prices would provide the answer to the problem of distribution, for the break-up of the net sales proceeds of each industry into wages costs, salaries, and return to property (rent, interest and net profit) is only another aspect of the distribution of the product of industry between the factors of production, which roughly corresponds with the distribution of the national income between the broad classes of society. Our present inquiry can make only the first step towards this analysis, since we have no information on the break-up of gross margins.

3. CONTRIBUTION OF THE INVESTIGATION TO AN ANALYSIS OF INDUSTRIAL EFFICIENCY

The significance of an empirical investigation into profit margins goes beyond its potential contribution to the theory of value and distribution. It also supplies important material for studying the efficiency of industrial production.

The empirical material relating to different trades enables us to study the productivity of labour (conveniently measured by output per head) in different trades, its variation within industries and its changes in time, and makes it possible to assess its effects on costs and on the use of labour resources.

In industries where profit margins are high (relatively to the amount of capital invested), excessive profits in relation to capital may still be eliminated by competition—not through the orthodox method of price-cutting—but by the socially more wasteful methods of excessive selling costs and surplus capacity. But the knowledge of profit margins themselves may also be important as a guide to the efficiency of production.

4. MAIN CONCEPTS USED IN THE COURSE OF ANALYSIS

It is with these major theoretical problems in mind that the inquiry into the distribution of the product of industry has been conducted for the last few years.

The main limitations set to any inquiry of this kind are the inadequate amount and the inadequate character of the empirical information available. This means that some aspects of the problem cannot be investigated at all, others only by using concepts which are justified by the statistical material available, but are only a rough approach to the correct economic concepts. Some of these difficulties will be discussed in more detail in Chapter II.

So far, the investigation has been based on the material (both published and unpublished) of the British Censuses of Production, and (for purposes of international comparisons) on the corresponding Censuses of other countries. This meant that it was restricted to the quantitative valuations of such concepts as could be extracted from Census material.

The basic concepts used in price and distribution analysis were gross margins in gross output and gross margins in net output and its complementary concept, the share of wages in the product of industry.

Gross output measures the sales proceeds of firms; it is therefore equivalent to the economists' concept of the value (price times quantity) of output. The 'prime costs of production' were treated as the sum of wages and material costs, while 'gross margins' were defined as that part of the sales proceeds which is in excess of prime costs. 'Net output', defined as gross output less the cost of materials used, is the appropriate concept for the distribution of the product of industry, since it is the approximate measure of the incomes generated through the activities of the firm.

The division of gross output into the categories of wages, material costs and gross margins and of net output into wages and gross margins, is, as we have seen, of primary significance, though not in itself adequate for studying the problem of entrepreneurial price behaviour. A high gross margin (in relation to prime costs) is not the same thing as high net profits on turn-over, still less a high rate of net profit on capital, since the gross margin covers all overhead costs—salaries, rents, rates, interest, depreciation, etc.—and selling costs, as well as net profit. For an adequate analysis, it will be necessary to break down the gross margin into its main component elements and also to obtain information on capital invested and productive capacity.

Owing to the absence of data, our analysis has not so far been extended along these lines.

The Board of Inland Revenue must in the course of their work obtain a considerable amount of information about the break-up of gross margins, the publication of which, industry by industry, would be most valuable. In particular, they must know the amount allowable for depreciation on equipment and the Schedule A assessment of industrial buildings which would also throw a light on the amount of capital employed. Information from this source could, however, only be linked with *Census* data with difficulty, and it seems most desirable that future Censuses should include questions about all the main constituents of gross margins and about the value of capital used.*

The *Census* definition of 'net output' is similarly only of approximative value for our purposes. To find the true measure of the value created (or incomes generated) through the activities of the firms, not only material costs, but also the depreciation of plant, and the costs of services bought outside the firm (such as fees for advertising), should be deducted from gross output. The *Census* enables us to deduct material costs and payments for some forms of work given out, but nothing else. This is a very imperfect measure of true net output, and our analysis of the share of wages in the distribution of the product of industry is correspondingly defective.

In relation to efficiency, also, our material provides at this stage only for very rough treatment. First of all, until we know the break-up of gross margins, we cannot distinguish any element in cost except prime cost. Secondly, we cannot separate differences in the value of output which are due to differences in quality from those due merely to differences in price.

Where there is reason to suppose that the output of the firms studied is fairly homogeneous, physical output per head can be calculated, and this provides us with a useful measure of the productivity of labour for making comparisons between different firms at any time, or for the whole industry between different dates. Various corrections should strictly be made if this is to be used as an index of efficiency. Thus the composition of the labour force in respect of age and sex has to be taken into consideration: a firm employing mainly women or juveniles should not automatically be regarded as less productive than one employing mainly men if its output per head is lower. Allowance for differences in hours worked is also needed.

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* The Census of Production Committee, appointed in 1945 to consider what additional information should be collected at future Censuses of Production, recommended the collection of both types of information mentioned above. (See *Report of the Census of Production Committee*, Cmd. 6687, 1945, pp. 8 and 18.)

An alternative approach where the firms are producing a homogeneous product is by studying prime costs per unit of output. This suffers from the defect that a firm may appear to be efficient merely because it pays less than the standard wage-rates, but this danger is not always serious. On the other hand, it has several merits. It automatically makes an allowance (albeit a somewhat arbitrary one) for variations in hours worked and for the varying proportions of juvenile and female workers, since their wage-rates are lower. It also makes an automatic allowance for variations in the amounts of fuel and materials used, which is clearly desirable. Like physical output per head, it takes no account of variations in the amount chargeable for depreciation. If comparisons between different years are wanted, allowance must, of course, be made for changes in wage-rates and prices of materials—not a very easy task.

Unfortunately for the statistician, the majority of industries do not consist of firms producing a reasonably homogeneous product. In these cases the only yardstick available is net output per head, which can be calculated for any firm for any year, and so superficially makes comparisons possible even between different industries. The *Census Reports* give plenty of warning against careless comparisons of the latter type. Comparisons over time naturally require different adjustments for price changes both for materials and for products.

Even within a single industry and a single year, the use of net output as a measure of efficiency is open to the serious objection that it reflects differences in the prices charged by the various firms (over and above those properly attributable to quality differences), as well as genuine differences in efficiency. In some industries this objection is so serious that the analysis is not worth making, but there are others where firms are producing broadly the same sort of articles, and it is reasonable to presume that buyers are sufficiently well informed to ensure that prices are kept fairly well in line. In such cases net output per head should give about as good a rough yardstick of efficiency as physical output per head does for industries with approximately homogeneous products. It has the advantage of making allowances for variations in fuel and material consumption, but otherwise suffers from the limitations discussed above.

5. PROCEDURE OF INVESTIGATION

The procedure of the whole investigation, in so far as fact-finding is concerned, can be summarized as follows:

(1) Investigations relating to the elements in the value of gross output and in the value of net output in the different British industries in all Census years (1907–35).

(2) Investigations relating to changes in the volume of production, in employment, in efficiency and in the prices of the factors of production (raw material costs, wage-rates, etc.) in the same industries and through the same periods as in (1).

(3) International comparison of data mentioned under (1).

(4) Division of gross margin into its constituent elements.

(5) Analysis of capital intensity, and its relation to profit margins.

(6) Investigation of prices, costs, distribution and productivity of different-sized units within selected industries.

Of these six problems, (1), (2) and (6) above are relevant to *The Relation of Wages to Gross Margins*, while (4) and (5) are relevant to *The Relation of Wages to Net Profits*. Most of the factual material relating to the first problem, *The Relation of Wages to Gross Margins*, has been completed, and will be published in due course.

6. NATURE OF THE SPECIAL INVESTIGATION DESCRIBED IN THIS STUDY

The present study is confined to the results of an investigation mentioned under (6) above. It attempts to give a cross-section analysis of the cost structure of certain British industries or trades, in the sense that prices and costs, profit margins and share of wages, and output per head of the different firms operating in the same trade have been investigated. Variations in the cost structure, etc., of these different firms in the same trade have been ascertained for one particular year, 1935, and these variations have been related to the size of the firm and of other factors, which may account for them.

This cross-section analysis of the cost structure of the selected trades has been supplemented by information relating to the structure and organization of the same trades and, in certain cases, by a time-analysis of the cost structure as shown by the successive *Censuses of Production*. The cross-section analysis relates to one particular year, and distinguishes between different-sized firms operating in the same trade. For example, it analyses the cost structure of different-sized firms producing cement in the year 1935. The time-analysis, on the other hand, is mainly concerned with changes in the prices and costs, profit margins and share of wages, and in output per head between Census years in these industries, but it treats the product of the industry considered as a unit. For example, it analyses how the cost structure of cement (produced by all the firms put together) has changed in the course of the last few decades.

The questions set in this investigation may be set out as follows:

(1) What is the pattern of cost structure of the different firms? In other words, under what cost conditions is the output of the industry produced?

(2) What is the relation of costs to prices? How do gross margins behave, especially as a function of costs?

(3) What is the relation of costs and efficiency to the size of the firm?

(4) What is the relation of share of wages (and of earnings of the workers per head) to the size of firm and to costs?

Of the subsequent chapters, Chapter II gives a description of the methods of investigation and procedure. Chapter III—which is the most important part of this study—gives the results of the analysis relating to the cost structure of selected British industries in 1935. Chapters IV–VII are case studies, which deal with changes in the cost structure of individual industries through time, covering usually the 30-year period before the outbreak of the 1939–45 war.

CHAPTER II

METHODS OF INVESTIGATION AND PROCEDURE

1. SOURCES OF INFORMATION

(i) Data relating to the cross-section analysis of individual trades, as presented in the form of tables and charts in Part II, have been compiled from unpublished material collected for the Fifth Census of Production. A special tabulation of these data has been made for the purposes of this investigation by the Statistics Department of the Board of Trade.

(ii) Data relating to the time-analysis (in Part III) have been compiled from the published material of subsequent censuses and other official and unofficial information.

The main sources of information used for purposes of the time-analysis in Part III have been:

The different *Censuses of Production*, particularly the *Final Report on the First Census of Production of the United Kingdom* (1907); *Final Reports on* *the Third Census of Production* (1924), Parts I–IV; *Final Report on the Fourth Census of Production* (1930), Parts I–V; *Report on the Import Duties Act Inquiry* (1933), Parts I and II; *Report on the Import Duties Act Inquiry* (1934), Parts I and II; *Final Report on the Fifth Census of Production and the Import Duties Act Inquiry* (1935), Parts I–IV; lastly, the *Preliminary Reports of the Import Duties Act Inquiry*, 1937 (*Board of Trade Journal*, 1939). The original intention had been to provide a quinquennial census; the 1912 Census, however, has never been completed owing to the outbreak of the war of 1914–18, and the few final data derived from this Census were published in the *Reports on the Third Census of Production.* From 1933 onwards the Import Duties Act, 1932, provided for a partial yearly census covering those trades which manufacture goods affected by the duties, i.e. over 60 % of all factory industries. Such inquiries were made in 1933, 1934 and 1937. In 1935 there was a complete census. Results of the 1937 Census again have remained uncompleted; preliminary reports in regard to the iron and steel and the textiles industries have been published, however, in the Appendices of the *Board of Trade Journal*, 1939.

For average earnings and hours of work, the first inquiry, in 1906, was made by the Labour Department of the Board of Trade. This was followed by the 'Earnings and Hours of Labour Inquiries' of the Ministry of Labour in 1924, in 1931 and in 1935. Results of the 1906 inquiry have been published in separate volumes; the results of the other inquiries have been published in the *Ministry of Labour Gazette*, 1926–7, 1933 and 1937.

For wage-rates E. C. Ramsbottom, 'The course of wage-rates in the United Kingdom, 1921–34', supplemented for 1934–7, *Journal of the Royal Statistical Society*, 1935, pp. 639–94 and 1938, pp. 202–4, has been consulted.

Salary rates and their changes have been based on a sample investigation by Mr H. Campion and Miss J. Marley. Some unpublished results of this investigation have been kindly supplied by the authors for the purposes of this inquiry.

2. DEFINITIONS USED

(i) *For purposes of the cross-section analysis*

The following terms have been used in exactly the same sense as given in the *Census* definitions:

Gross output represents the net selling value of all goods manufactured in the year, whether sold or not. *Net selling value* is defined as the actual amount charged to customers after deduction of discounts and payments to railway companies and other transport undertakings for carriage outwards. In other words, the goods were valued at the stage of delivery at which they passed out of the hands of the employees of the producing firm and on the basis of immediate cash payment. If delivery was effected by the producing firm's own staff and means of transport, no deduction of transport costs was made, since the employees engaged in delivering the products were included as part of the firm's total staff, and the value of the products was required to cover the value of the services of all the firm's employees.

Firms were instructed to return the value of their sales in the year, plus the value of stocks held at the end of the year, and less the value of stocks at the beginning. Stocks were valued at their 'book' value, i.e. at the value assigned to them for the purposes of the firm's own accounts at the two dates.

Materials used covers all classes of materials, including packing materials, fuel, and electricity, and materials used in the repair and maintenance of the firm's own buildings. 'The cost' represented the total amounts paid for material in the year, plus the book value of stocks at the beginning of the year and less the book value of stocks at the end. The figure included payments to railway companies or other transport undertakings for conveyance of the goods to the purchaser's works and, if the goods were purchased through merchants, the merchants' handling expenses and profits were also included.

Net output is the figure which results from the deduction of the aggregate cost of materials and fuel used and the amount paid for work given out, from the total value of the gross output. This figure represents the value added to materials by the industrial processes. It does not correspond to true net output for reasons discussed on p. 7.

Wages represents the aggregate amount of wages paid by firms which furnished returns of wages to all their operatives during the year. For 1906 the wages data were collected by the Board of Trade, though it was not done on the Census of Production form. Under the Census of Production Act (1906), the Board of Trade is prohibited from requiring, in connexion with the Census of Production, particulars of the amount of wages paid. Voluntary inquiries were, however, conducted simultaneously with the Censuses of Production by the Ministry of Labour and, by arrangement with the Ministry, the total wages bill was ascertained for all those firms whose returns made to the two Departments could be linked up.

Operatives is defined as covering all wage-earners, including foremen, van and lorry drivers and warehousemen, employed in or about the factory or works, or in outside work of construction or repair. *Adminis-*

trative, technical and clerical staff (salaried staff) covers the office and management staff, including working proprietors, managing directors, managers, designers, salesmen, travellers, etc., clerks, typists and other persons engaged primarily in office work.

Average number of persons employed in the year represents the aggregate of operatives and salaried staff.

The following additional terms have been used:

Prime costs represents the aggregate of the value of material costs and of wages costs. This is a rough measure of prime costs in the economic sense (see p. 17).

Gross margins is the difference between the selling value at works and prime costs, and includes such items as selling costs (advertisement costs, etc.), fixed charges (interest, etc.), salaries, social and other insurance charges paid by employers, rents and/or royalties, rates, depreciation and net profits.

Price per unit of physical output represents the value of gross output divided by the quantity of physical units produced. Thus the unit price is really equivalent to the average selling value of one unit of the product. It should be noted that in cases where we deal with an intermediate product, like pig-iron, the bulk of which does not go to the market, but is transferred to another plant—or another department of the same plant—the average selling value is hardly more than an accounting concept and is not unit price in the economic sense.

Prime costs, *Material costs* and *Wages costs per unit of physical output* represent the aggregate value of prime costs, of material costs and of the wages bill respectively divided by the quantity of physical units produced.

Establishments, firms and business units. In this study we use the concept 'unit', which is nearest to the *Census* 'establishment' concept. It is essential however to see where it differs from the other *Census* terms.*

An *establishment* as used in the *Census* signifies a single factory, workshop or other place of business at which some process involving the transformation of material was carried on. A *firm*, on the other hand, has been defined for each group of trades as the aggregate of establishments owned by a single firm and operating under the same trading name; companies that make returns under their own name are included as separate firms although they may form part of, or be associated with, larger combinations for purposes of trading. Lastly, *business units*—the concept applied to the Census material by Mr Leak and Mr Maizels—

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* Whenever we use the term 'firm' in the text, we use it in the literary sense and not in the technical sense. In other words, the technical concept behind it is the 'unit' as defined on p. 14, and not the 'firm' as defined by the *Census*.

represents the aggregate of firms owned or controlled by a single company and employing 500 persons or more, control being defined as ownership of more than half the capital, or voting power, of each firm.

At the 1935 Census firms were required to furnish separate returns for each establishment, whether engaged in the same trade or not, and all the statistical material in this study is based on these returns relating to the several individual establishments. Some firms, however, have supplied aggregate data—on such items as wages paid and physical output—for all the several establishments owned by them, and it was therefore necessary to regard each of these firms as one unit.

It is believed that the use of this hybrid concept which we call unit has not affected appreciably the results relating to the non-homogeneous trades. Potentially it has greater importance in regard to the industries with homogeneous products. Here, however, we found that in one case only, that is, in the cement trade, is there an appreciable difference between the number of 'establishments' and 'units'. For this industry, most of the computations have been carried out both for establishments and for units.* In the case of pig-iron, tinplate and sugar, the number of firms and establishments is identical, and in the other cases the difference is negligible.

Size of firm is measured by the average number of persons employed.

(ii) *Further definitions used for purposes of the time-analysis*

In addition to the terms used for the purposes of the cross-section analysis, the following terms have been used for purposes of the time-analysis:

Salary bill represents the number of salaried staff as given in the *Census of Production Reports* multiplied by the estimated average salaries in the respective trades. The estimated average salaries are based on a sample investigation made by Mr H. Campion and Miss J. Marley.

Social insurance contributions represents the payments made by employers of operatives. (The employees' contribution is paid out of their wages and is thus included in the wages bill.) This has been ascertained on the basis of the number of operatives, as shown in the *Census Reports*, and of the rates of contributions and estimated number of weeks of contributions, based on the official social insurance statistics.

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* This was possible only by allocating among the individual establishments in proportion to the relative numbers of employees, the wages bill and physical-output data supplied on the same return for the several establishments of the same firm. It is interesting to note that in the case of the cement trade we arrive at the same broad conclusions irrespective of whether the material is grouped according to 'establishments' or 'units'.

Horse-power. For purposes of the 1930 Census all firms indicated the capacity of prime-movers, electric generators and electric motors in the works. With regard to prime-movers the capacity to be stated was the effective horse-power which they could develop, for electric generators the rated capacity in kilowatts, and for electric motors the rated horse-power. In addition, electric motors were divided as between motors driven by electricity generated in firms' own works and motors driven by purchased electricity. A further classification of all power equipment differentiated between horse-power ordinarily in use containing all engines which were in use during the greater part of the year of return, even if they were not working to their full capacity; and engines which were not in use during the greater part of the year or which were only used occasionally or during periods of breakdown of machinery ordinarily in use, were classified as 'in reserve or idle'. For purposes of calculating *horse-power per head* or per unit of output, the total horse-power has been taken here to be represented by the aggregate of the horse-power of prime-movers and of electric motors driven by purchased electricity. This is the method followed by the American *Censuses of Manufactures*, and is somewhat simpler than the method followed by the British *Censuses of Production.**

The rate of average earnings represents average actual earnings per operative, usually in one selected week of the year, as ascertained by the Ministry of Labour.

Hours of labour shows the average hours actually worked in the week, as ascertained in one selected week of the year by the Ministry of Labour. Short time and hours worked in excess of the normal week have been taken into account, but loss of time by individual workers due to voluntary absence from work, sickness, bad time-keeping, etc., is only partially accounted for. If full account had been taken of absences from work from all these causes, the figures relating to hours actually worked would usually have been somewhat lower, on average, than shown.

3. STATISTICAL LIMITATIONS

The use of Census material for the purposes of this inquiry, both in Part II and Part III, leads to certain limitations. These arise partly out of the inappropriateness of the *Census* definitions of the various categories for the purpose of this analysis, partly they are the result of the lack of data on certain topics. The limitations of our results due to these shortcomings have to be borne in mind.

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* The British method of calculating total horse-power—as described in Part V, Chapter x, of the *Final Report on the Fourth Census of Production* (1930)—is more comprehensive than the American method, as it allows, among other factors, for loss of energy in transmission. But using the horse-power per head data, compiled for both countries by the same method, mostly for inter-country comparisons, the simpler U.S. method also serves our purpose.

Perhaps the greatest limitation with which any investigation of this kind is faced is the non-homogeneity of the output of most industries. There are really two problems: first, most firms make more than one product, so that it is difficult to add their output up in terms of a single physical unit; and secondly, there are nearly always considerable variations of quality, type, size, etc., in the output of what is classed as a single product. This latter difficulty can to some extent be overcome by having a sufficiently detailed classification of products, but important quality variations within any definable heading will nearly always remain.

Among the industries analysed in detail, a very few only, e.g. cement or pig-iron, can be regarded as approximately homogeneous. Even in the latter industry we found, as is shown on pp. 101–124, that there were a number of clearly distinguishable products, which had to be treated to a certain extent as separate products.*

Another problem which has arisen in the course of analysis—of great importance for the cross-section analysis—was that in many cases small firms had prices and costs quite out of proportion to the rest of the industry, suggesting that they are producing some specialized product. In other cases, e.g. blast furnaces, we found that some of the products, forge and foundry pig-iron, were produced mainly by small and medium firms, while basic and acid pig-iron were produced mainly by medium and big firms. In the biscuits and wallpaper trades, where there are enormous price ranges, we found that small firms were producing small quantities of either cheap or very expensive products, and the bulk of the output is produced by the big firms (as in the case of wallpaper) or by medium and big firms (as in the case of biscuits, where big firms produce most of the medium price ranges).

All these difficulties mainly affected the cross-section analysis. In the time-analysis of different industries, another complication arising from lack of homogeneity has been encountered. In dealing with different firms in the same industry, we have to assume that the product they are producing is the same. In dealing with the same industry in different years, we have to assume that the product of the industry as such remained the same. In other words, there is no possibility of allowing for qualitative changes which may have occurred in the course of time. Cement is an obvious case in point, where considerable qualitative improvement has taken place in the period under review. Secondly, where the industry is producing more than one product, as in the case of ordinary pig-iron and basic pig-iron, a change may have occurred in the relative importance of these component items which affects both average costs and average prices. Thirdly, the scope of the trade as defined by the *Census* may change, and part of the manufacturing process may be treated in different Census years as a different industry. Again cement is an example, where quarrying of lime has become a separate trade from the 1930 *Census* onwards. As far as possible adjustments have been made to eliminate the effects of the last two difficulties mentioned above. Nevertheless, a general caveat in regard to imperfections of the homogeneity of the product is worth recording.

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* The difficulty of product specification can be clearly illustrated in the case of spirit-distilling. The published *Census Reports* give 'plain spirits' as its main products, and apart from a few firms producing exclusively yeast classified into the same trade, the industry appears to be entirely homogeneous. 'Plain spirits' covers, however, two main products, industrial spirits and potable spirits (whisky), which show enormous price differences, are made from entirely different raw materials differing very considerably in price and are produced by different processes. As the *Census Reports* do not indicate which firms produce potable spirits and which produce industrial spirits, or the extent to which any firm produces the one or the other, spirit-distilling clearly cannot be treated as a trade producing a homogeneous product.

Another statistical limitation arises from the definition of gross margin. The definition appropriate for this concept is the difference between selling value at works, excluding transport costs, and the prime costs of production, consisting of wages and raw materials. The *Census* definition neither of selling value nor of prime costs is, however, quite satisfactory. The net selling value or gross output in some cases includes transport costs; thus differences in prices of different firms may be accounted for by differences of the place of delivery. Moreover, the value of gross output as defined by the *Census* is 'the selling value of the goods made and the value of the work done, plus the book value of the stocks at the beginning of the year, less the book value at the end of the year'. The determination of the true value of the goods produced requires that stocks at the beginning and at the end of the period should both be valued at the same prices, which will not generally be the case if there have been price movements.

Further, costs of materials used, and the amount of wages paid, as given in the *Census*, include the repair, maintenance and improvement of buildings undertaken by firms for themselves. For calculating prime costs it would have been desirable to exclude these items, although for a study of distribution they are properly included. Again, the wages bill includes 'overhead wages', i.e. the wages of indirect labour (maintenance, etc.), which cannot be regarded as entering into prime costs.

Finally, prime costs as defined for purposes of this inquiry—the aggregate of material costs and wages costs—contains overhead wages or wages of operatives used for transport, but it excludes depreciation. Theoretically it should include all short-run variable costs; thus, in addition to wages and costs of raw materials, that extra depreciation of equipment caused by the extra output, which Lord Keynes called 'user cost'. It is doubtful, however, how far depreciation enters into the producers' calculation of prime costs.

Turning to net output as defined by the *Census* we find that it is only the nearest approach to true net output, that is, to the contribution of manufacturing industry to the national output. It includes, for example, services paid for advertising, insurance, banking, etc., which are analogous to costs of materials, and should have been deducted from the value of gross output. Net output also includes depreciation. This shortcoming of the *Census* net output concept is directly relevant to the share of wages concept.

The next limitation arises from the concept of 'unit' to which data in Part II refer; it is an unsatisfactory concept from the economic point of view. The relevant concepts are those of the plant (to which the *Census* concept of establishment comes very near) and of the business concern, roughly corresponding to the business unit concept.* It would be, for example, interesting to relate productivity of labour (physical output per head) to different size of plants, and to relate share of wages to different size of business units. To apply the concept of 'unit' in both cases represents the nearest approach possible at present, but not an entirely satisfactory one, although, as shown elsewhere, the effect of this limitation is small.

Another limitation arising from the use of Census material is that wages data are based only on a sample, although a large one, and that they have been collected independently from the rest of the Census information. There is no evidence, however, that the sample is in any way biased, in the sense, say, that only firms paying good wages make returns.

A further limitation arises from the exclusion of small firms (that is, with ten or less employees) from the 1935 Census of Production. This factor has, however, hardly affected the results of the analysis in Part II. There are no small firms in the blast-furnaces and tinplate trades, only a few in the cement, wallpaper, biscuits and sugar trades, and their number is significant only in the butter and margarine group.

It should also be noted that in many cases the number of firms in a size group is small, and the grouping of the firms into size groups is somewhat arbitrary. By giving averages for size groups instead of for firms, and by reducing the number of size groups in order to prevent disclosure of information, some of the variations, which might be of relevance, have been eliminated.

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* As applied by Mr Leak and Mr Maizels, in their paper 'The Structure of British Industry', *Journal of the Royal Statistical Society*, 1945, Part II.

The comparability of the different Censuses is a further limitation imposed on the time-analysis in Part III. This comparability is affected by such factors as: changes in the geographical field covered, as, for example, in the 1907 Census which covered the whole of Ireland; the different treatment of small firms; and the changes in classification. Considering that Part III does not give absolute figures but mainly ratios, the comparability of data for different years is hardly affected.

All the above statistical limitations in the present paper arise from the fact that the *Census* concepts or *Census* classifications are not entirely in agreement with the concepts used in this analysis. Another kind of limitation is mainly economic in character. It arises from the fact that the information given in the *Censuses of Production* and other published material, official and otherwise, is insufficient to answer fully and satisfactorily many of the questions raised by the economic analysis. For example, in regard to individual trades information would be required about how far use is made of their existing capacity if we are to see how far firms with low costs of production could expand their actual production; and it would also be of interest to the economist to know what the quality is of their unused capacity. Unfortunately, such information is not available.*

The major items of further information needed for a really adequate economic analysis relate first to the capital equipment and the type of organization of different firms and of different industries, that is, their capital intensity and the changes in their capital intensity. Secondly, information would be needed on the breakdown of the gross margin into its constituent elements, such as depreciation, other capital charges, selling costs and net profits.

As for capital intensity, horse-power data are the one source of information easily available; these have, however, many shortcomings as a measure of capital intensity, and unfortunately have not been collected for purposes of the 1935 Census. Another potential source of information, published balance sheets, has too many pitfalls to be of great use.

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* Some information can be derived, of course, from the horse-power statistics of the 1924 and 1930 *Censuses*.

4. TRADES CHOSEN

The internal cost structure of the following twenty *Census* trades was analysed:

Broadly homogeneous trades

1. Blast furnaces.
2. Tinplate.
3. Cement.
4. Biscuit.
5. Margarine.
6. Butter.
7. Sugar and glucose.
8. Wallpaper.

Non-homogeneous trades

9. Copper and brass.
10. Shipbuilding.
11. Seed crushing.
12. Starch and polishes.
13. Fertilizer, disinfectant, glue, etc.
14. Cotton (spinning and doubling).
15. Jute.
16. Brewing and malting.
17. Spirit distilling.
18. Tobacco.
19. Soap, candle and perfumery.
20. Gloves.

The first eight trades are trades with broadly homogeneous products. The other twelve trades have a more varied product structure; they are roughly arranged in accordance with whether they produce capital, intermediate or consumption goods. Even in the case of some of the first eight, however, further subdivisions going beyond the classification of the *Census* trades were necessary, if we wished to relate part of the analysis to approximately homogeneous products. We have distinguished, therefore, within some of the eight trades, sections producing the following products:

1. Forge and foundry pig-iron.
   Acid pig-iron.
   Basic pig-iron.
2. Tinplate.
3. Cement.
4. Biscuits (net selling value £3–4 per cwt.).
   Biscuits (net selling value £2–3 per cwt.).
   Biscuits (net selling value £1–2 per cwt.).
5. Margarine.
6. Creamery butter.
   Blended butter.
7. Refined sugar made from home-grown sugar.
   Refined sugar made from imported raw sugar.
8. Wallpaper.

5. PRINCIPLES APPLIED IN CHOOSING THE TRADES

The twenty trades enumerated have been selected on the following basis:

(i) We attempted to include most of the trades with products which are sufficiently homogeneous for calculations relating to unit of physical output to be made. Unfortunately, as can be seen, these are very few in number.

(ii) We included one or more trades from capital goods trades, consumption goods trades, trades producing durable and trades producing perishable goods. We have chosen one or more trades from each of the more important of the twelve main *Census* manufacturing groups, e.g. the iron and steel group, the textile group, etc.

(iii) We wanted to have *Census* trades which are not composite trades, such as, say, electrical engineering, which is composed of at least twenty-five trades, but groups which are much more compact, such as the jute trade.

Within these limits we were indifferent as to which trades were selected. On the whole, half of the trades chosen produce finished consumption goods, the others produce intermediate products or capital goods. The twenty trades were selected out of nine manufacturing groups, and while some of the twenty selected consist of several hundred firms, as in cotton-spinning or shipbuilding, the others consist of a few firms only, as in the margarine trade.

The net output produced by the twenty trades amounts to 15·5 % of the net output of all factory trades. The total number of persons employed by these trades amounts to 12·1 % of the persons employed by all factory trades. Roughly speaking, *one-eighth of all factory trades is covered by our sample.*[*]

[*] Appendix 1, p. 139, gives further information on the methods employed in carrying out the investigation.

PART II

CHAPTER III

COST STRUCTURE OF SELECTED BRITISH INDUSTRIES, 1935: ANALYSIS OF RESULTS

1. VARIATIONS IN PRICES AND COSTS

In analysing the cost structure of certain British trades, that is, the prices and costs of different firms operating in the same trade, the first observation which can be made is the great variability of prices and costs from firm to firm. Wide variations can be observed whether we compare absolute differences, that is, unit prices and unit costs of different firms, or whether we compare relative differences, that is, the proportion of different cost elements in the value of gross output of the different firms.

The following examples will show the extent of these variations. Taking the relatively homogeneous trades first, the following variations of unit prices and unit costs can be observed among firms grouped according to size:

(i) Trades with relatively small variation of prices and costs:

Blast furnaces (excluding smallest firms):
Selling price varies from £2·72 to £2·81 per ton.
Prime costs vary from £2·48 to £2·66 per ton.
Gross margins vary from £0·10 to £0·29 per ton.

Tinplate:
Selling price varies from £18·70 to £20·60 per ton.
Prime costs vary from £15·80 to £18·00 per ton.
Gross margins vary from £2·30 to £3·20 per ton.

(ii) Trades where both selling prices and costs vary:

Cement:
Selling price varies from £1·45 to £1·70 per ton.
Prime costs vary from £0·73 to £1·14 per ton.
Gross margins vary from £0·46 to £0·72 per ton.

Margarine:
Selling price varies from £1·71 to £1·93 per cwt.
Prime costs vary from £1·03 to £1·46 per cwt.
Gross margins vary from £0·47 to £0·68 per cwt.

Similar variations can be observed in all the other trades. Individual firms naturally exhibit much greater variations than groups of firms.

Similarly wide variations can be observed in the relative importance of elements of costs in the value of gross output of different firms, both in the homogeneous and also in the heterogeneous trades. The variations are especially great in gross margins and costs of materials (and to a much lesser extent in wages) as a proportion of gross output. The most conspicuous variations can be seen in the following trades:

Trade	Costs of materials as percentage of gross output in size groups		Gross margins as percentage of gross output in size groups	
	Lowest	Highest	Lowest	Highest
Cement	35·2	61·1	20·0	52·4
Margarine	35·7	71·2	23·9	39·6
Biscuits	39·9	56·2	25·1	48·4
Fertilizers	56·0	65·4	22·4	33·0
Soap	47·1	63·4	26·8	44·4

These observed variations in prices and costs from firm to firm operating in the same trades raises a number of questions:* Is there any definite pattern recognizable in these variations? Can the cost structure of any one industry, that is, the cost conditions under which the output is produced, be ascertained? What is the relation of prices and costs? How do gross margins behave, especially as a function of costs? Is there any interrelation between variations in prices and costs and the size of the firm? It is these questions with which we are concerned in the next sections.

2. INTERRELATIONSHIP OF PRICES, PRIME COSTS AND GROSS MARGINS (THE COST STRUCTURE OF THE INDUSTRIES)

(i) *Pattern of cost structure in the homogeneous trades*

(*a*) *Prime-cost curves of individual trades.* The pattern of cost structure of different trades can be best illustrated by drawing their prime-cost curves. This curve shows the costs under which the output of the individual trades has been produced, by indicating the prime costs of different firms in ascending order; it approximates to the Marshallian

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* It is, of course, assumed that we compare unit prices and unit costs of identical products. Similarly, we assume that we compare the relative importance of the elements of costs in gross output of firms performing the same manufacturing process, i.e. starting at the same stage of converting raw materials or semi-finished products into a more finished product. Otherwise the great variations have no theoretical significance and there is no point in exploring the interrelationships in these variations.

'particular expenses curves'.[*] The prime costs indicated in the Charts in Group IV on pp. 186–8 are adjusted for price differences;[†] nevertheless, they give a good indication of the cost conditions of the trade.

The first type, of which blast furnaces and tinplate are the main examples, shows a slightly increasing prime-cost curve; no firm can be regarded as a representative firm, no firm's contribution to the total output is outstanding or shows peculiar cost characteristics. Creamery butter producers show a similar curve.

The second type of prime-cost curves—of which cement and margarine are the main examples—is entirely different. In these trades—as the curve indicates—the bulk of the output is produced at relatively low prime costs and relatively high gross margins. A small proportion of the output is produced at high prime costs with low gross margins.

(*b*) *Relation of costs to prices.* In drawing the prime-cost curves we assumed identical prices throughout the industry and adjusted prime costs accordingly. In actual fact, however, prices of firms differ, and the second question which we can ask is: What is the relation of costs to prices? How do gross margins behave, especially as a function of other costs?

Three types of pattern emerge among the trades analysed:[‡]

(*a*) Prices of different firms are fairly close together, while prime costs vary; price variations, however, are not correlated with variations

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[*] See A. Marshall, *Principles of Economics*, 8th ed. 1938, p. 810 n.

[†] For a description of the method used in drawing the particular expenses curves and limitations of these curves, see Appendix 1, § 1.

[‡] The interrelationship of prices and costs (the dispersion of selling price, the correlation of selling price and of the different elements of costs and the regression of different cost elements on selling prices) of individual firms have been further analysed by the usual methods. No additional general results emerged from this analysis, but in certain aspects they helped to express the interrelationship in a more precise form. Some of the main results are given in Appendix 3.

In these calculations first of all we attempted to partition the dispersion of the selling prices of the different firms in each industry into the part associated with each of the constituent costs and additional terms associated with the intercorrelation of these costs. In this way we wanted to test whether variations in selling price are completely explained by, say, the variations of material costs or variations of margins, etc. This is tested by taking the variance of selling price which is identically equal to the sums of the variances of its component elements—that is, material costs, wages costs and gross margins—plus the contributions arising from the interrelations of the constituents. If any of the correlations between the constituents are negative, the sum of the first three terms may be greater than the variance of the selling price.

In all cases considered, as shown in the Appendix, we found that the sum of the variances of the components is offset by terms involving the negative correlation between them, especially between material costs and gross margins. Thus the dispersion of the selling price cannot be simply apportioned between the variability of the three constituents.

In regard to the correlation between selling price and its constituents—also set out of prime costs. Lowest margins go with highest prime costs and vice versa. The trades which conform to this pattern are pig-iron* and tinplate; in both cases, however, there are deviations to be observed. Creamery butter producers are another example, although in this latter case prices are not so close to each other.

(*b*) Prices and prime costs are positively correlated, but price variations are *smaller* than variations in prime costs. Lower prime costs go with higher margins. The trades which conform to this pattern are cement, margarine, sugar-refining.

The cement trade is the most typical example. In this trade prices on the whole tend to move with prime costs (though not quite regularly). Thus the general picture is: prices moving with prime costs, but by less, so that the highest gross margins accompany the lowest prices. There is also associated with lower prices an absolute increase in gross margins, so that the difference between prices is smaller than the difference between prime costs.

(*c*) Prices and prime costs are positively correlated, but the price variation is *greater* than the prime-cost variations. Highest gross margins go with the highest prices. Butter blenders appear to conform to this pattern, and the small firms in the pig-iron trade (mainly forge- and foundry-iron producers), as do the wallpaper trade and some ranges of the biscuits trade.†

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in the Appendix—it must be remembered that not all these correlations are between independent variates, but between a given variate and one of its constituents (e.g. between selling price and material costs, which latter is part of selling price). It is partly for this reason that the correlation between selling price and material costs (or selling price and prime costs) is usually high and positive. Selling prices and wages costs are positively correlated in two cases only, biscuits and wallpaper; in the same trades, and also in the beet-sugar trade, prices are also correlated with gross margins.

Testing the correlations between the independent variates in the usual way, it may be said that in certain cases, cement and margarine, there is a significant negative correlation between gross margins and wages; in the case of pig-iron a significant negative correlation can be observed only in regard to gross margins and material costs; in the case of tinplate only in regard to gross margins and wages costs. In the case of biscuits and wallpaper the correlation is positive, though not significant. In the case of wallpaper the correlation between material costs and gross margins is negative, but not significant.

The regression equations are not given in the Appendix, as they have not led to any significant positive conclusion.

* This is also true in the basic pig-iron and acid pig-iron trades, if treated as separate trades, and in analysing individual firms, and not only in analysing size groups.

† It is mainly on the basis of the correlations of the cost ratios of individual firms that biscuits and wallpaper appear to conform rather to the third pattern. They show a bias to the second pattern. The line of division in certain cases is not quite clear.

(ii) *Interpretation of cost patterns*

In the light of these relationships, we can discuss with reference to the homogeneous trades the various hypotheses set out in Chapter I above. We can also, for this purpose, make some use of the information about the non-homogeneous trades, which is presented in Charts Groups I–II on pp. 167–83. These charts show the break-up of gross output as between gross margins, wages and costs of materials.

(*a*) The conventional margin. This hypothesis assumes that profit margins are determined by the customs and traditions ruling the various industries. Each firm fixes its price by adding to the average prime costs the traditional overhead per unit of actual output or per unit of 'standard' output (that is, 'full' or conventional 'full' output), and a further conventional addition is made for profits. This conventional addition for profits may vary from firm to firm according to their 'full costs'. The actual variations in gross margins ascertained in the different trades are so great that they do not give any support to this assumption.

This hypothesis can also be tested for all the non-homogeneous trades. Charts Group II on pp. 167–75 show the variations in gross margins (as a percentage of the value of gross output) between different-sized firms. These variations in gross margins as between different size groups are very substantial without exception in all non-homogeneous industries, and do not give any support to the 'conventional margin' hypothesis.

(*b*) 'Fair prices.' According to this hypothesis gross margins are determined by overhead costs. We have no direct information on the break-up of gross margins, but there is a strong presumption that where high margins are due to high capital costs, high margins should be correlated with high output per head. This is clearly not the case in the trades which we have found to conform to the first and third patterns. In those following the first pattern no marked relationship between output per head and gross margins was found. In the third, high margins were found to be associated with low output per head, which seems, on the face of it, completely to rule out the 'fair-price' hypothesis. In trades of the second pattern, high margins go with high output per head, and there is, in general, reason to suppose that in many cases the lower prime costs of the large firms are partly due to higher capital and administrative costs. The case of cement, examined in more detail in Chapter IV, suggests, however, that this is by no means the whole story, and that the high gross margins of the large firms are not fully accounted for by high overhead costs.

For the non-homogeneous trades we cannot measure physical output per head in different size groups so as to say how they are correlated with margins, but we should equally expect that high gross margins, as a proportion of gross output, will be correlated with high net output per head, if both were due to high capital costs. In three trades, fertilizers, breweries, and starch and polishes, we find that net output per head is positively correlated with the share of gross margins in the value of gross output. In a number of trades this correlation is less strong, but still can be observed to some extent; these are cotton-spinning, soap, copper and brass, tobacco, seed-crushing and shipbuilding; in the jute, gloves and spirit-distilling trades, the tendency is not so definite. For most of the trades (except cotton-spinning) where positive correlation has been found, there are reasons to believe (on the basis of general information relating to the state of competition in these trades) that the high gross margins of the large firms are not fully accounted for by their employment of a large amount of capital per unit of output.

A tentative interpretation of the three patterns may be made as follows: In the first, a large number of small firms are selling at closely similar prices, and the picture would be compatible either with broadly competitive conditions, or with a system under which prices are fixed by agreement at a level which permits the firms with the highest prime costs to make some profit.

In the second pattern also prices are not widely different as between firms, and it may be assumed that the market is not very imperfect, though some price differences do exist. But this is not equivalent to saying that competition is perfect; it implies merely that buyers are sufficiently well aware of prices charged by different firms to insure that no great price difference can exist for similar products. Perfect competition requires that the number of independent sellers is so large that no one can exercise an appreciable influence on the price of his product. In these trades this second condition is absent—a few firms dominate the industry. It seems reasonable to suppose that these firms set the level of prices for the whole industry. On what principles the price is set the data cannot tell us, but it appears to be at a level which allows the large firms relatively high net margins, while it permits the survival of the small firms with high prime costs. Prices vary with prime costs, but price variations are smaller than the variations in prime costs. This suggests that the more efficient firms 'pass on to the consumer' part of the advantages of superior efficiency, while retaining part in the form of profits.

In the third pattern, prices vary with prime costs, but by more. The commodities produced are less homogeneous than in the first two patterns and the market is presumably more imperfect. The general picture appears to be consistent with the analysis according to which profit margins are influenced mainly by the elasticity of demand for the output of the individual producer.

These interpretations are necessarily made with the reservation that much further information would be needed to establish them. One conclusion, however, emerges clearly. There is very great variety in the conditions ruling in different types of market and different sections of industry, and no single formula can be made to cover all cases.

3. SIZE OF FIRMS AND 'EFFICIENCY'

(i) *Comparison of physical output per head, prime costs per unit of output, net output per head, gross output per head, in different-sized firms*

The next question which we shall investigate is whether there is any relationship between the size of a firm and its efficiency. For this purpose we shall apply the three tests of efficiency discussed in Chapter 1:

Test 1. High physical output per head.
Test 2. Low prime costs per unit of physical output.
Test 3. High value of net output per head.

As a supplementary test of efficiency, we will also consider the variations in value of gross output per head between different size groups. Test 4 of efficiency will be therefore: High value of gross output per head.

Considering this fourth and supplementary test, it will be interesting to see how far the same results emerge, if we use gross output per head as a measure of efficiency instead of net output per head. In so far as the firms are doing the same sort of work, a high net output per head will generally imply a proportionately high consumption of materials per head, so that the pattern should be very similar. It is possible, however, that the high net output per head might represent the performance of elaborate work on the same quantity of materials, in which case the pattern will be less marked though probably the same general type of pattern will emerge.

These four tests can conveniently be applied by studying the Charts in Groups I and III, pp. 159 and 177. Group III Charts show the variations in physical output per head and also the variations in prime costs per unit of output between different size groups for all the homogeneous trades. Charts in Group I show the variations in the value of net output per head and of gross output per head between different size groups for all the twenty trades considered. This information can be summarized as shown in Table 1.

Table 1. *Size of unit and efficiency in the selected trades*

Trade	(1) Efficiency increases with size	(2)	(3)	(4)	(5)	(6)
	Clearly	Clearly apart from smallest size groups	Partially	Medium firms are most efficient	Efficiency decreases with size	No clear-cut tendency
			A. *Homogeneous trades*			
Margarine	All 4 tests	—	—	—	—	—
Cement	—	All 4 tests[*]	—	—	—	—
Sugar refineries	Test 2	—	—	—	Tests 1, 3, 4	—
Tinplate	—	—	All 4 tests	—	—	—
Biscuits (price range £2–3)	Tests 3, 4	—	Tests 1, 2	—	—	—
Biscuits (price range £3–4)	—	—	—	—	—	All 4 tests[†]
Butter blenders	—	—	—	All 4 tests	—	—
Creamery butter	Tests 1, 3, 4	—	—	—	Test 2	—
Basic pig-iron	—	—	—	—	—	All 4 tests[‡]
Acid pig-iron	—	—	—	—	All 4 tests	—
Forge and foundry iron	Tests 1, 3, 4	—	—	—	Test 2	—
Wallpapers	Tests 3, 4	—	—	—	—	Tests 1, 2
			B. *Non-homogeneous trades*			
Tobacco	Tests 3, 4	—	Test 3	—	—	Test 4
Spirit-distilling	Tests 3, 4	—	—	—	—	—
Shipbuilding	—	Tests 3, 4	Tests 3, 4	—	—	—
Copper and brass	—	Tests 3, 4	Tests 3, 4	—	—	—
Breweries	—	—	Tests 3, 4	—	—	—
Seed-crushing	—	—	Tests 3, 4	—	—	—
Starch and polishes	—	Test 3	—	—	—	Test 4
Soap	—	—	Test 3[§]	—	—	Test 4
Fertilizers	—	—	—	Test 3	—	Test 4
Cotton-spinning	—	—	—	—	—	Tests 3, 4
Gloves	—	—	—	—	—	Tests 3, 4
Jute	—	—	—	—	—	Tests 3, 4

Note. Test 1. High physical output per head.
Test 2. Low prime costs per unit of physical output.
Test 3. High value of net output per head.
Test 4. High value of gross output per head.

[*] Test 3 shows a bias towards 1; test 4 shows a bias towards 3.

[†] Test 3 shows a bias towards 3.

[‡] On tests 1–2 there is a bias towards 4.

[§] Some small size groups do not conform to this pattern.

The main conclusion which can be drawn from these comparisons is that increasing returns operate over the wide field of British industrial activity that has been examined. We measured efficiency in the four different ways (high physical output per head,[*] low prime costs per unit of physical output, high value of net output per head and high value of gross output per head) for the homogeneous trades, and used the last two methods for the non-homogeneous trades, finding that the different methods led in the majority of cases to identical results. Taking the results of all the four measurements into account, we found that in the following trades efficiency increases with size:

Margarine
Cement
Tinplate
Biscuits (price range £2–3)
Creamery butter
Forge and foundry pig-iron
Wallpapers (on two tests only)

Also

Tobacco
Spirit-distilling
Shipbuilding
Copper and brass
Breweries (partially)
Seed-crushing (partially)
Starch (partially)
Soap (partially)

Medium firms are the most efficient in the butter-blending and fertilizer trades. No clear-cut tendency can be ascertained in the basic pig-iron trade (although there is a bias for medium firms to be most efficient), in the biscuits trade (price range £3–4), in the cotton-spinning, gloves and jute trades. In the acid pig-iron trade and on certain tests in the sugar-refining trades, there even appears to be a tendency for efficiency to decrease with size, but there are two size groups only in both trades, and too few firms have been considered to justify any conclusions.

[*] This is the first time that such information has been compiled for a number of British industries. The only other trade for which such information has been available is coal-mining. The Samuel Report showed that output per man-shift rises with almost complete regularity as the size of the colliery increases (see Tables 5 and 31 of the *Report of the Royal Commission on the Coal Industry*, 1925). In the *Statistical Digest* for the coal industry (Cmd. 6538, 1944), data are given, from which certain conclusions on the relative efficiency of different-sized mines (in terms of physical output per head) can be drawn. An analysis of these data (by F. A. Burchardt in the *Bulletin of the Oxford University Institute of Statistics*, 4 Nov. 1944, pp. 250–5) shows that size of pits and labour productivity are positively correlated in the sense that a larger proportion of big pits have output per head over the average than either small or medium pits. But the data do not appear to be sufficiently detailed to allow of clear-cut conclusions in regard to the relation of size and productivity in coal mines.

(ii) *Scale of operations and efficiency*

It is interesting to see whether industries which show increasing returns are those where the typical firm is large.

To ascertain whether the typical firm is large, medium or small we applied a simple test. We tried to find out whether the greatest proportion of workers in a given trade is employed by large-, medium- or small-sized firms. In most trades more than half of the total number of workers is employed in the size group which is typical of the whole trade and in the remaining cases somewhat less. Firms employing 1000 or more employees were regarded as big firms, those employing 200–999 employees as medium firms, and those employing less than 200 employees as small firms. These limits have been chosen because for the factory trades of the *Census of Production* as a whole about one-third of the employees can be found in each of these three groups.

We found that in the following trades the typical firm is large:

Sugar-refining
Shipbuilding
Tobacco
Biscuits (price range £3–4)
Soap (employment fairly equally divided between three groups)

In the following trades the typical firm is medium-sized:

Basic pig-iron
Acid pig-iron
Tinplate
Cement
Margarine
Wallpaper
Blended butter
Biscuits (£2–3)
Copper and brass
Seed-crushing (bias to large typical firm)
Starch and polishes (bias to large typical firm)
Cotton-spinning
Jute
Breweries

In the following trades the typical firm is small:

Forge and foundry iron
Fertilizers
Spirit-distilling
Gloves
Creamery butter

If we compare this grouping with the classification of trades according to their efficiency in 3 (i) above, it is obvious that increasing returns are not dependent on the typical firm being large. Some trades where the typical firm is large showed no increasing returns with size, while some trades where the typical firm is small exhibited such a tendency. The lack of correlation is especially conspicuous for the homogeneous trades. For the non-homogeneous trades, in most of those trades (except spirit-distilling) where the value of net output increases with size, we found that the typical firm is either large, largish or at least medium-sized.

(iii) *Relation between size and efficiency in the U.S.*

It is interesting to note than an inquiry in the U.S.* covering very largely the same range of industries, but with homogeneous products, found a much more obvious and clear-cut relation between increasing size of plant and increasing efficiency.

This investigation related to plant (not to firm) and used the method of comparing costs of production per unit of output, and also the supplementary method of comparing rate of return on capital invested. The material was largely derived from special tabulations of data collected by the Federal Tariff Commission and related to the following trades: cement, iron ore, pig-iron, steel ingots, also crude petroleum, beet sugar, milk distribution and bread. In practically all cases, but especially in the case of industries with which we have been concerned, the inquiry found that the trend of costs declines markedly as the size of the plant increases.

4. EARNINGS AND SIZE

The wages bill per head in the different size groups is our best available index† for measuring variations in earnings per head of the workers in different size groups operating in the same trades. For this reason, the relation of earnings per head to the size of firm, that is, earnings of the worker to size and the relation of earnings per head to efficiency, require further examination.

There is altogether very little variation in earnings per head in different-sized firms, as can be seen from Charts, Group I on pp. 159–66; average earnings per head are the least variable of all the cost factors.

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* John M. Blair, 'The relation between size and efficiency of business', *Review of Economic Statistics*, August 1942, no. 3. The same article is a convincing criticism of a Temporary National Economic Committee monograph (no. 13) on *Relative Efficiency of Large, Medium-sized and Small Businesses*, prepared by the Federal Trade Commission. This latter monograph seemed to prove that large plants and companies are generally less efficient in terms of unit costs and rates of return than medium-sized or even, in some cases, small-sized organizations. Mr Blair successfully challenges both this conclusion and also the statistical methods used upon which the conclusion of the F.T.C. has been based. The method employed by Mr Blair is the same as that employed by the present study, i.e. the ordinary frequency distribution.

† The only shortcoming of this index is that it relates the total number of persons employed (i.e. including salaried employees) to the wage bill in each size group, and thus it does not take into account the fact that the ratio of salaried employees to operatives may differ as between different size groups. This point is further discussed in Appendix 4. This index also ignores the potential differences in the composition of the labour force (i.e. the ratio of males to females or of adults to juveniles) as between different size groups. Neither does it allow for possible variations in short time or overtime working as between different-sized firms.

In so far as the average earnings of operatives differ between different size groups,[*] these differences may be due to the following factors: (*a*) different-sized firms, generally speaking, pay different hourly wage-rates, and, where earnings increase with size, bigger firms pay better wages, irrespective of efficiency, or they may employ more skilled labour; (*b*) or specifically, firms which are more efficient, that is, firms which have higher productivity of labour, pay higher wages.

First, we inquired whether earnings per head do vary with size, and whether earnings per head in big firms are higher than earnings per head in small firms. This latter relationship can be tested by comparing the earnings per head, in each industry separately, of half of the workers employed by the bigger firms with earnings per head of the other half employed by the smaller firms. Owing to the character of the data, it has not been possible to split up the number of operatives in two exactly identically sized groups; roughly speaking usually more than half of the workers were grouped into the bigger-sized firms and consequently somewhat below half in the smaller-sized firms. Table 2 expresses the earnings per head in the smaller-sized firms as a percentage of earnings per head in the larger-sized firms.

Table 2. *Earnings and the size of unit*[*]

Gloves	106·5	Copper and brass	92·9
Butter	103·7	Soap	92·3
Cotton-spinning	103·6	Biscuits	91·7
Shipbuilding	102·8	Tinplate	87·8
Blast furnaces	102·2	Spirit-distilling	84·9
Seed-crushing	101·1	Wallpaper	83·8
Sugar-refining	95·9	Breweries	82·3
Jute	95·8	Starch and polishes	77·8
Cement[†]	95·5	Tobacco	70·9
Fertilizers	94·3	Margarine	56·4
	Unweighted average	91·8	
	Weighted average	94·6	

[*] Earnings per head in bigger firms equals 100; based on Board of Trade individual returns.

[†] Allowing for differences in the ratio of salaried staff to operatives in the different size groups.

This table shows that out of twenty trades examined, in fourteen trades higher earnings per head are obtained in the bigger firms than smaller firms, and in six trades higher earnings per head are obtained in the smaller firms. The differences are, however, small. The weighted

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[*] These differences may also be due, of course, to the statistical limitations mentioned in the footnote above.

Table 3. *Variations in average earnings in different-sized units*, 1935 (*in index numbers*) (*average earnings* = 100)*

Size of firm (no. of persons employed)	Blast furnaces	Tinplate	Ship-building	Copper and brass	Fertilizers	Soap	Seed-crushing
11–24	—	—	88·4	90·0	93·6	115·4	78·9
25–49	—	91·1	94·2	95·5	96·7	99·5	
50–99	88·7		102·9	91·0	97·9	88·3	95·3
100–199	107·5	93·8	91·2	106·1	99·1	100·5	95·6
200–299	81·7	85·9	109·8	88·2	108·1	77·2	107·1
300–399	111·5	99·1	96·4	99·0	—		—
400–499	94·8	99·0	110·8		—	108·3	99·6
500–749	104·1	110·4	101·9	102·7	—	93·6	—
750–999	—	102·2	99·0	—	—	122·5	—
1000–1999	—	—	92·1	—	—	—	—
2000 and over	—	—	101·3	—	—	—	—

	Starch and polishes	Cement†	Cotton-spinning	Jute	Gloves	Wall-paper
11–24	83·3	77·8	106·0	—	88·8	85·7
25–49	99·6		100·0	90·4	119·1	
50–99	64·6	111·9	103·0	—	104·0	92·8
100–199	—	106·2	95·0	95·4	97·9	81·4
200–299	86·6	—	105·0	98·4	—	105·6
300–399	—	97·5	98·0	101·2	—	—
400–499	108·4		102·0	97·7	—	—
500–749	—	—	100·0	102·3	—	—
750–999	—	—	94·0	—	—	—
1000–1999	—	—	67·0	—	—	—
2000 and over	—	—	—	—	—	—

	Biscuits	Margarine	Butter	Spirit-distilling	Breweries	Tobacco
11–24	94·2	—	103·9	—	82·8	74·2
25–49		—	98·8	87·9	84·7	84·9
50–99	85·7	—	103·7		86·6	74·0
100–199	88·1	—		102·9	88·4	70·6
200–299	77·7	67·6	98·9	—	88·6	74·2
300–399	80·7	—		—	91·6	—
400–499		—	—	—	—	84·5
500–749	94·1	119·8	—	—	111·2	81·5
750–999		—	—	—	120·8	—
1000–1999	106·9	—	—	—	—	111·3
2000 and over	—	—	—	—	—	—

* This table was compiled on the basis of data supplied by the analysis of individual *Census* returns. The wages bills calculated for size groups in different trades were related to the average number of persons employed. Salaried persons were excluded on the assumption that the proportion of salaried persons to the total employed available for individual trades is applicable to all size groups within the trades.

It should be noted that there might be differences in the number of days worked in 1935 within the size groups.

The last size group in each trade usually covers the corresponding size in the left-hand column and all other firms over this size.

† For the cement trade, after allowing for differences in the ratio of salaried staff to operatives.

average of all twenty trades gives an index of 94·6, i.e. in the twenty trades considered smaller firms show hardly more than 5 % lower earnings per head than bigger firms. The unweighted average of the twenty trades is much lower, 91·8 %.

Variations in average earnings per head in the different-sized firms are shown in Table 3.

Only in seven cases, fertilizers, soap, margarine, spirit-distilling, breweries, tobacco, and to a lesser degree in the case of wallpaper, do we find that earnings increase as the size of firm increases. A similar though not so clear tendency can be observed for the tinplate trade. In all other cases there is little variation and no apparent regularity.

5. EARNINGS AND EFFICIENCY

Of the eight industries analysed, where physical output per head in different-sized firms has been computed, we find a positive correlation between labour productivity and earnings of workers per head in the margarine, wallpaper, blast-furnaces and (to a lesser extent) in the tinplate and cement trades. In these trades higher labour productivity goes with higher average earnings and lower labour productivity with lower average earnings. In the first two trades mentioned the size factor also operates in the sense that bigger firms have higher labour productivity and bigger average earnings. In the butter trade there is no correlation between labour productivity and earnings per head; in the sugar-refining and in the biscuits trades the picture is not clear.

For industries where net output per head and gross margins per head are the only indices for measuring relative efficiency, the effect of higher labour productivity on average earnings per employee can be tested either by comparing the trend of average earnings per head with the trend of net output per head or by comparing it with the trend of gross margins per head in the different size groups. It should be remembered, however, that on the one hand earnings per head are part of net output per head, on the other that higher gross margins per head can be regarded only as a very imperfect index of higher labour productivity.*

On the strength of both tests, we find that (*a*) in all cases where higher physical output per head has been associated with higher earnings per head, that is, in the margarine, wallpaper, blast-furnaces, and to some extent also in the tinplate trades, higher earnings per head are also associated with higher net output or with higher gross margins per head; (*b*) in addition, in the following additional trades we found that higher earnings per head go with higher net output or with higher gross margins: sugar-refining, spirit-distilling, breweries, tobacco, seed-crushing; (*c*) in the following trades this positive correlation is not quite clear-cut, but is still existent: shipbuilding, starch and polishes, gloves and biscuits; (*d*) in the cotton-spinning, jute and cement trades, earnings per head and net output or gross margins per head are negatively correlated; (*e*) lastly, in the copper and brass, butter, fertilizers and soap trades the relationship is not clear.

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* As explained in Chapter II, high gross margins per head may reflect higher net profits per unit, as well as greater efficiency.

It may be added that, as Group I Charts show, the differences in wages per head in different-sized firms are extremely small, and thus the variations which arise in the value of net output per head are almost entirely due to differences in gross margins. Moreover, in most cases examined, gross margins per head are quantitatively so much more important than wages per head that net output per head will largely express differences in gross margins per head.*

The main conclusion which can be derived from this analysis is that in a number of trades there is a positive correlation between average earnings per head and efficiency as measured by physical output per head or by net output or gross margins per head respectively. In other words, it appears that some advantages of higher labour productivity are 'passed back' to the workers in the form of higher earnings. This may be explained in several ways: it may be the case either that efficient firms become more prosperous and thus can afford to pay higher wages of their own accord; or that they may employ more skilled labour, or that labour is well enough organized to secure for the wage earners at least part of the advantages of higher labour productivity.

The fact that, in certain cases, earnings per head and labour productivity are positively correlated also explains why variations in wages costs from firm to firm are relatively small. From the two factors determining wages costs per unit one would expect that labour requirements per unit would vary more than wage-rates, and this is borne out by empirical evidence. If, furthermore, in some trades wage-rates are higher where labour productivity is high (that is, labour requirements are low), this would be a factor in bringing wages costs per unit in different-sized firms even closer together. In the tinplate trade, for example, where earnings and labour productivity are positively correlated, differences in wages costs are small, while in the cement trade, where earnings and labour productivity are negatively correlated, differences in wages costs are substantial.

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* The only exceptions where wages per head are quantitatively more important than gross margins per head are the shipbuilding, cotton-spinning, jute and glove trades. In the first two trades mentioned, wages per head and gross margins per head move in a parallel direction, while the latter two trades do not exhibit any particular pattern.

6. RELATION OF SHARE OF WAGES TO SIZE OF FIRM

(i) *Degree of variation of share of wages among different size groups*

In the previous sections we analysed separately the relation of the two constituents of net output, wages and gross margins, to the size of firm. In this section we examine variations of the share of wages in the value of net output, in relation to size. The share of wages in the value of net output can be regarded as the most representative single indicator of the structure of distribution of income in industry.

Table 4. *Share of wages in the value of net output in different-sized units in twenty selected trades,* 1935*

(1) Size group (no. of persons employed)	(2) Share of wages in net output	(3) Average of share of wages in net output in (2)
11–24	31·5	30·7
25–49	28·6	
50–99	29·4	
100–199	32·5	
200–299	41·6	40·7
300–399	42·6	
400–499	63·3	
500–749	31·2	
750–999	37·2	
1000–1499	32·0	32·4
1500–1999	23·2	
2000–2499	48·1	
2500 and over	20·9	20·9
Total of selected trades	32·3	32·3
Total of all factory trades	43·8	43·8

The relation of share of wages in net output to size in British industry in general, that is, in the aggregate of the twenty industries covered here, can be seen from Table 4.

The picture which emerges from this table is that there does not appear to be, at first sight, any definite relationship between size of firms and share of wages. On the whole it seems that the highest share of wages is obtained in the medium-sized firms (200–999 employees), while it is lower in the small and big firms.*

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* This table is based on Board of Trade individual returns. The difference between the average share of wages of all trades and of the selected trades is due to the heavy weight in the sample of trades having a low share of wages.

It is altogether more relevant to consider the relation of share of wages to size in the individual industries. The following patterns can be distinguished:

(*a*) *Share of wages declines with size:* cement, margarine, wallpaper, seed-crushing, sugar and, to a certain extent, tobacco.

(*b*) *Share of wages increases with size:* jute.

(*c*) *Small and big firms have high share of wages and medium firms low share of wages:* fertilizers, gloves.

(*d*) *Medium firms have high share of wages, small and big firms low share of wages:* blast furnaces, tinplate, copper and brass, shipbuilding, soap, cotton-spinning, breweries and biscuits.

(*e*) *No distinct relationship:* spirit-distilling, starch and polishes, butter.

It is interesting to note that all trades where the share of wages declines with size (that is, industries where big firms have the lowest share of wages) are strongly concentrated, in the sense that the three largest 'business units' control a substantial proportion of employment. All the trades included in this same group also show positive correlation between efficiency and size.

Trades which are not strongly concentrated in the above sense or are not otherwise known to be monopolistic are mostly found in group (*d*). In these medium-sized firms have the highest share of wages. One possible explanation of this type is that big firms usually have high gross margins because they employ more capital or are economically more powerful, while small firms have high gross margins because they are specialists and therefore sell on an imperfect market or work to special orders and/or their capital is under-employed.

(ii) *Degree of variation of share of wages among different-sized firms*

We have already seen that share of wages in net output varies as between different size groups. It is interesting to go beyond the size groups and examine the share of wages of individual firms. The variation exhibited by individual firms operating in the same trade is even greater than those shown by the size groups, and the average share of wages computed for any particular trade covers therefore very wide divergences among the different firms in the same trade. For individual industries we found that the variations are within a range of from under 10 % to 100 % or over.

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* The picture as presented in Table 4, at least in regard to big firms, is, however, somewhat biased by the fact that up to a certain size nearly all twenty industries enter into each size category, while in the upper strata of size groups only a few industries may enter into the aggregate. For example, out of the twenty industries considered only the following trades have firms with 1000 or more employees: shipbuilding, cotton-spinning, biscuits, breweries, and tobacco, of which the first two have high and the last three low average share of wages.

Considering that the variations in the share of wages from firm to firm within each trade are usually greater than variations from one trade to another,* it is important to know whether the factors determining the share of wages for any particular firm or group of firms within a trade depend upon the type of trade in which the firm or groups of firms operate or are due to chance factors. In other words, can we speak of a typical share of wages in net output in this or that trade in general and in its firms and groups of firms? Can it be said that for definite reasons, whatever these reasons may be, e.g. in the cement trade in general, in its firms and groups of firms, the share of wages will be generally speaking low, while in the blast-furnace trade in general, in its firms and groups of firms, high?

To measure the variation of share of wages within each industry as between individual firms, each firm has been allocated into a 'share of wages group', the groups representing 10 % intervals. For example, there is a share of wages group of 10–20 %, then 20–30 % and so on. We find that with four exceptions, all the trades considered contain individual firms stretching out into at least seven or eight of these groups (cotton-spinning into at least twelve groups). The exceptions are cement, margarine, butter and spirit-distilling, mostly trades with a small number of firms, three of them also with very low share of wages.

Nevertheless, in spite of these wide variations, we can observe a type of concentration round the average share of wages for the trade, and thus in a sense we can speak of a typical share of wages for each trade.† We find, for example, that classifying all firms according to both size of firms and size of share of wages the median firm in regard to share of wages in each size group falls either into the row of the average share or (with one or two exceptions) into the row next either below or above.

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* The patterns and significance of the variation of share of wages from trade to trade will be analysed in a future study. This problem can be dealt with more adequately by considering all the *Census* trades in Britain and not only the twenty-odd trades analysed in this paper.

† It is possible that we should find a smaller variation in the share of wages from firm to firm if the *Census* trade groups or subgroups were to cover groups rather more homogeneous than at present. We often find that firms classified into the same *Census* groups, but producing different, though related, products, e.g. yeast and spirits in the spirit-distilling trade, or butter and margarine in the butter trade, have widely varying shares of wages. Thus some proportion of the variation of the share of wages from firm to firm may be due to the technical difficulty of further product differentiation, though it is certain that all variations are not due to this factor.

(This can be seen in Tables 5–27, Group A, pp. 49 ff., where the median firm in each size group is shown thus: ▦1▦.) We also found one of the following types of close concentration round the average share of wages in all trades but two:

(1) *Closest concentration:* at least three-quarters of all firms have share of wages falling into the row of the average or the adjoining two rows, and about one-quarter of all firms have share of wages falling into the average row: tinplate, seed-crushing, jute, biscuits, margarine, spirit-distilling.

(2) *Close concentration:* at least half of all firms have share of wages falling into the row of the average or the adjoining two rows, and about one-quarter of all firms have share of wages falling into the row of the average: copper and brass, cement, shipbuilding, starch and polishes, tobacco, soap, gloves, wallpaper, fertilizers and cotton-spinning.

(3) *Diffused types:* pig-iron, butter.

An examination of the share of wages of individual firms within each trade has brought out one further point, important in interpreting the determining factors of high or low share of wages, whether in any particular firm or in a particular industry.

A low share of wages in the value of net output reflects high gross margins, i.e. a high share of gross margins in the value of net output, although the explanation of this high share of gross margin may differ from case to case. It may equally be due to a high degree of monopoly or to higher capital intensity, or weak labour organizations accompanied by exploitation of the workers. It can also be explained by good trade conditions and temporary exploitation of prosperous markets. High share of wages in the value of net output, on the other hand, may be caused either by the competitive character of the market (and consequently low gross margins) or by a strongly organized labour market accompanied by high wages. It may also be caused by bad business conditions and consequential business losses in the particular period of observation. In this latter case, many firms find it difficult or impossible to pay even wages out of the fund represented by the net output, and little or nothing is left to cover the different items of gross margins. In such cases the share of wages will be near or over 100 %. One would expect that firms which are unable to cover even their prime costs out of their proceeds will go out of business, but one year, covered by the *Census*, may prove too short a period to lead to such consequences, and these firms may carry on on reserves or bank credits for a while.

1935 was a fairly normal year; nevertheless, in many trades we found firms where the share of wages was near or over 100 %. This case occurred most frequently in cotton-spinning, where fifty-two firms had a share of wages over 90 %, and another fifty-four over 100 %, out of 462 firms considered; in shipbuilding there were thirty-four cases over 90 % out of 173, and in the copper and brass trade fifteen cases over 80 % out of 112; in the glove trade there were seven cases out of fifty-three, in the jute trade five cases out of fifty-seven, two cases out of thirty-one in the blast-furnaces trade and two cases out of fifty in the tinplate trade.*

7. SHARE OF WAGES AND EFFICIENCY

The next question investigated was the relationship of the share of wages to efficiency. For the homogeneous trades we can compare physical output per head with the share of wages in the value of net output, while for the other industries we can compare only net output per head with the share of wages.

For the homogeneous trades we found that in the cement, margarine and sugar-refining trades, also in forge and foundry iron and acid pig-iron (and partially also in the tinplate trade), high efficiency goes with low share of wages, and vice versa. We found a similar relationship in most of the non-homogeneous trades, such as seed-crushing, starch and polishes, breweries, tobacco and fertilizers. The correlation is less obvious in the cotton-spinning, copper and brass, gloves, soap and shipbuilding trades, though it can still be observed. The correlation is absent from a few trades only, from basic pig-iron or wallpaper, among the homogeneous trades, and from spirit-distilling and jute among the non-homogeneous trades.

The fact that in most of the trades firms with high efficiency show low share of wages is compatible, of course, with several hypotheses as regards pricing. On the 'pure-competition' hypothesis the higher margins of low-cost firms may merely represent the differential rents earned owing to superior opportunities or superior skill or ability of management. On the 'fair-price' hypothesis the correlation may be attributed to the greater amount of capital per unit of output employed by the more efficient firms; while on the 'conventional margin' hypothesis it is the existence of the high-cost, low-margin firms which may be attributed to the excessive margins charged by the low-cost firms. On the 'elasticity of demand' hypothesis, on the other hand, the correlation could only be explained as a result of the relatively greater processing of materials, per unit of labour, of the more efficient firms, and the consequent higher share of material costs in total prime costs. Since, however, the same firms which have a relatively high gross margin in net output also have a relatively high gross margin in gross output,* this hypothesis is untenable. Further progress in this problem would require an investigation of the relation of capital employed per unit of labour as between efficient and inefficient firms.

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* Of these trades cotton-spinning, shipbuilding and jute were contracting industries. As explained elsewhere, the fact that the wages bill is higher than the value of net output may be due to complications arising out of stock valuations. (See pp. 140–1.)

8. SHARE OF WAGES AND EARNINGS (ALSO SHARE OF WAGES AND UNIT COSTS)

In the previous section we have shown that high efficiency goes with low share of wages and low efficiency with high share of wages. Given the efficiency of a firm, there are two other factors which may also have an influence on the share of wages of the firm. The firm may have a high share of wages because it is less efficient than its competitors, and therefore its wages costs in relation to its profits are higher. But the firm might be just as efficient as other firms, and still have high share of wages, because it charges lower prices per unit or because it pays higher wage-rates. At the same time firms may have a low share of wages not only because they are efficient, but also because they are able to charge higher prices or they are able to pay lower wages.

We can analyse the effect of these two further factors by comparing share of wages first with unit prices and secondly with average earnings per head.

(i) In Tables 39–44 in Group C, unit prices and unit costs of individual firms for the homogeneous trades are grouped according to their share of wages and not according to their size. As can be seen from these tables, no clear relationship between prices per unit and share of wages can, however, be established. In two trades, cement and wallpaper, prices rise as the share of wages rises, but simultaneously all other cost elements also rise. In another group, pig-iron and tinplate, selling prices fall as the share of wages increases. It does not appear that variations in unit prices of different firms have much effect on the variations in the share of wages.

(ii) The variations of earnings per head in relation to variations in the share of wages between different-sized firms can be examined for all industries analysed.† There is no relation between earnings per head and share of wages, i.e. high shares of wages are not caused by high earnings of the workers, but by other factors.

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* As can be seen from Group II Charts.

† Tables 5–27 in Group A, pp. 49–62.

Variations in wages costs per unit in their relation to share of wages can also be examined for the homogeneous trades.* They will reflect the combined effect of efficiency and earnings per head already examined separately. We have found that in many of the homogeneous trades, such as cement, tinplate and margarine, high wages costs go with a high share of wages. This is not the case in the pig-iron trade. This correlation is not due to the effect of the earnings per head factor, and is thus caused mainly by the efficiency factor.

9. SUMMARY OF CONCLUSIONS

Three main problems were in view when we undertook the analysis of the data on different-sized units in certain British trades; that is, the analysis of the data relating to prices and costs, to profit margins and share of wages, and to output per head of the *different firms operating in the same trade*. We were interested in how prices are determined by individual firms, and our especial interest was in the considerations that determine the relation of the selling price to the prime costs of production, that is, in the profit margins. Secondly, the interrelated question of distribution concerned us, and here the object of our analysis was to discover how the product of industry is distributed among the factors of production and in particular between wages and profits. Thirdly, we were concerned to discover how productivity of labour, as conveniently measured by output per head, varies in general in the different trades, and in particular how it varies in relation to the size of the firm.

Our analysis yielded valuable facts relating to all three problems; they are set out in the form of tables and charts. We have also attempted a tentative interpretation of these facts. Both these facts and the interpretation are put forward, however, with a strong emphasis on the need for much further factual investigation and analysis before a satisfactory answer can be given to any of the problems raised.

(i) *Interrelationship of prices, prime costs and gross margins*

An examination of the cost structure of certain British trades, that is of prices and costs of different firms operating in the same trade, revealed great variability of prices and costs from firm to firm. Wide variations were observed whether we compared unit prices and unit costs of different firms or whether we compared the different cost elements in the value of the gross output of these firms.

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* See Tables 39–44, Group C, pp. 71–3.

In analysing the interrelationship of prices, prime costs and gross margins within each industry, we were not able to discover any single formula or hypothesis which would explain these interrelationships in all the industries analysed. We found that there is a very great variety in the conditions ruling in different types of markets and different sections of industry, and that no single formula can be made to cover all cases.

We are able to test some of the hypotheses, such as the conventional margin hypothesis and the fair price hypothesis, on the basis of our data. The conventional margin hypothesis assumes that profit margins are determined by the customs and traditions ruling in the various industries. We found that the actual variations of gross margins ascertained in the different trades analysed are so great that they do not give any support to this hypothesis.

The fair price hypothesis assumes that gross margins are determined by overhead costs. We have no direct information on the break-up of gross margins, but the hypothesis can nevertheless be tested on the basis of a strong presumption that where high margins are due to high capital costs, high margins should be correlated with high output per head. When the industries analysed were divided into three groups, two groups of industries showed no signs of such a correlation. In one of these two groups, no marked relationship between output per head and gross margins was found, in the other high margins were found to be associated with low output per head. In the third group high margins accompanied high output per head, and in general there is reason to suppose that the high gross margins of the large firms are due to higher capital and administrative costs. But it does appear from other information relating to these industries that this is by no means the whole story and that the high gross margins of the large firms are not fully accounted for by high overhead costs.

Among the industries producing broadly homogeneous products which we analysed more intensively, we discovered three patterns of pricing. These patterns and their tentative interpretation can be summarized as follows. In the first, a large number of small firms are selling at closely similar prices. This pattern is compatible either with broadly competitive conditions, or with a system under which prices are fixed by agreement at a level which permits the firms with the highest prime costs to make some profit. The blast-furnaces trade and the tinplate trade conform to this pattern. (See Charts 53 and 54, pp. 191 and 192.)

In the second pattern also prices are not widely different as between firms, though some price differences do exist. Prices vary with prime costs, but price variations are smaller than the variations in prime costs. It may be assumed that the market is not very imperfect. But the competition is not perfect as a few firms dominate the industry. It seems reasonable to suppose that these firms set the level of prices for the whole industry, and it appears that they set it at a level which allows the large firms relatively high margins, while it permits the survival of the small firms with high prime costs. The cement and margarine trades appear to conform to this pattern. (See Charts 55 and 57, pp. 193 and 195.)

In the third pattern, prices vary with prime costs, but to a greater extent. The commodities produced are less homogeneous than in the first two patterns and the market is presumably more imperfect. The general picture appears to be consistent with the analysis according to which profit margins are influenced mainly by elasticity of demand for the output of the individual producer. The wallpaper trade and some ranges of the biscuit trade seem to conform to this pattern.

(ii) *Size of firms and efficiency*

Measuring efficiency in four different ways (high physical output per head, low prime costs per unit of physical output, high value of net output per head and high value of gross output per head) for homogeneous trades and by the last two methods for non-homogeneous trades, we found that the different methods led in the majority of cases to identical conclusions. This conclusion is that increasing returns operate over the wide field of British industrial activity that has been examined. In most of the trades which we have analysed we found that efficiency increases with the size of the unit. Some of the trades to which this conclusion applies are margarine, cement, tinplate, tobacco, spirit distilling, shipbuilding, copper and brass, and a number of other trades. Medium firms were found to be most efficient in two trades only, for five trades no clear-cut tendency can be ascertained, and in two trades efficiency appears to decrease with size.

We also found that an increase in efficiency with size is not dependent on the typical firm being large.

American investigations suggest that in a group of U.S. industries that have been analysed, covering broadly speaking the same range as our homogeneous trades, there is also a clear-cut and perhaps even more obvious relation between increasing size of plant and increasing efficiency.

(iii) *Earnings and size—Earnings and efficiency*

Earnings per worker are not closely correlated to size. Although, out of twenty trades analysed, in fourteen trades higher earnings are obtained in the bigger firms than in the smaller firms, these differences are very small, on the average not more than 5 %. Out of the twenty industries, in seven cases only did we find that earnings increase as the size of the firm increases.

There is a closer relationship between earnings per worker and efficiency. In a number of trades we found that earnings per worker and labour productivity are positively correlated. In other words, it appears that some advantages of higher labour productivity are 'passed back' to the workers in the form of higher earnings. This may be explained in several ways: it may be the case either that efficient firms become more prosperous and thus can afford to pay higher wages of their own accord; or that they may employ more skilled labour, or that labour is well enough organized to secure a share of the benefits.

(iv) *Share of wages and size of firms—Share of wages and efficiency—Share of wages and unit costs*

The share of wages in the value of net output can be regarded as the most representative single indicator of the structure of distribution of income in industry.

First of all we analysed variations in the share of wages among different-sized firms as well as different size groups of firms within the individual trades. We found that the variations in the share of wages from firm to firm within each trade are usually greater than the variations from one trade to another or from one size group to another in the same trade. Nevertheless, in spite of these wide variations from firm to firm, we can observe a type of concentration round the average share of wages for the individual trades concerned, and thus in a sense we can speak of a typical share of wages for each trade.

Grouping the firms into size groups we found that for the aggregate of the twenty industries analysed the highest share of wages is obtained in the medium-sized firms (200–999 employees), while it is lower in the small and big firms. It is more relevant, however, to consider the relation of share of wages to size in individual industries. Among the twenty trades analysed we distinguished five patterns, but most industries fell into two patterns: either share of wages declines with size (six trades fell into this category) or medium firms have high share of wages, small and big firms low share of wages (eight trades fell into this other category). All six industries which show that share of wages declines with size are strongly concentrated, in the sense that the three largest business units control a substantial proportion of employment. Industries which are not strongly concentrated in the above sense or are not otherwise known to be monopolistic conform to the second pattern mentioned above, i.e. medium-sized firms have the highest share of wages. One possible explanation of this type is that big firms usually have high gross margins because they employ more capital or are economically more powerful, while small firms have high gross margins because they are specialists and therefore sell on an imperfect market or work to special orders or their capital is under-employed.

We found a close relationship between share of wages and 'efficiency' (measured in terms of physical output per head for the homogeneous trades and in terms of net output per head for the non-homogeneous trades), among the individual firms in the different trades analysed. As we explain, the fact that in most of the trades analysed firms with high 'efficiency' show low share of wages is compatible with several hypotheses as regards pricing.

Efficiency is, however, only one of the many factors affecting the share of wages. A firm may have high share of wages because it is less efficient than its competitors, and therefore its wages costs in relation to its profits are higher. But the firm might be just as efficient as other firms, and still have high share of wages, because it charges lower prices per unit or because it pays higher wage-rates (or for some other reason). At the same time firms may have a low share of wages because they are able to charge higher prices or because they are able to pay lower wages (as well as for other reasons).

In so far as our data allowed, we analysed the effect of these two factors on the share of wages. We found that variations in unit prices of different firms do not appear to have much effect on the variations in the share of wages. Neither is there any relation between earnings per head and share of wages, i.e. high share of wages is not caused by high earnings of the workers, but by other factors.

GROUP 'A' TABLES

SHARE OF WAGES IN THE VALUE OF NET OUTPUT, ITS DISPERSION AND THE ELEMENTS OF COSTS IN THE VALUE OF GROSS OUTPUT IN DIFFERENT SIZE GROUPS

Table 5. *Blast Furnaces (all producers)*

Cols. (4)–(11) show the number of units having varying share of wages in the value of net output

(1) Size group (no. of persons employed)	(2) No. of units in the size group	(3) Weight of the group (proportion of persons employed)	(4) 20–30 %	(5) 30–40 %	(6) 40–50 %	(7) 50–60 %	(8) 60–70 %	(9) 70–80 %
50–99	5	4·4	—	2	—	1	—	1
100–199	8	12·8	1	1	—	3	1	—
200–299	5	13·8	—	—	1	3	—	1
300–399	6	22·7	—	2	—	1	1	1
400–499	7	46·3	—	—	—	—	—	3
500 and over			—	—	—	1	1	—
Total	31	100·0	1	5	1	9	3	6

	(10) 80–90 %	(11) 90 % and over	(12) Average share of wages in the value of net output	(13) Proportion of Costs of materials in the value of gross output	(14) Proportion of Wages costs in the value of gross output	(15) Proportion of Prime costs in the value of gross output	(16) Proportion of Gross margins in the value of gross output
50–99	—	1	53·3	75·6	13·0	88·6	11·4
100–199	2	—	48·4	79·8	9·8	89·6	10·4
200–299	—	—	56·0	81·2	10·5	91·7	8·3
300–399	1	—	51·7	82·2	9·2	91·4	8·6
400–499	1	1	68·5	82·9	11·6	94·5	5·5
500 and over	—	—					
Total	4	2	57·7	81·7	10·5	92·2	7·8

Table 6. *Producers of different types of pig-iron*

Quality of pig-iron	Costs of materials % gross output	Wages costs % gross output	Prime costs % gross output	Gross margins % gross output	Wages costs % net output	Gross margins % net output
Forge and foundry:						
Small units	63·8	16·7	80·5	19·5	46·1	53·9
Medium units	69·3	13·0	82·3	17·7	42·3	57·7
Total	68·1	13·8	81·9	18·1	43·3	56·7
Basic:						
Smaller units	83·8	9·3	93·1	6·9	57·4	42·6
Medium units	82·4	9·5	91·9	8·1	54·0	46·0
Large units	86·9	10·2	97·1	2·9	77·9	22·1
Medium and large units	84·6	9·9	94·5	5·5	64·3	35·7
Total	84·4	9·8	94·2	5·8	62·8	37·2
Acid:						
Medium units	77·4	9·3	86·7	13·3	41·2	58·8
Large units	82·6	13·1	95·7	4·3	75·3	24·7
Total	80·3	11·4	91·7	8·3	57·9	42·1

Source. Census of Production. A sample of individual returns, covering about 17 % of foundry- and forge-iron production, 42 % of basic pig-iron production and 54 % of acid pig-iron production.

Table 7. *Tinplate (all producers)*

Cols. (4)–(11) show the number of units having varying share of wages in the value of net output

(1) Size group (no. of persons employed)	(2) No. of units in the size group	(3) Weight of the group (proportion of persons employed)	(4) 20–30 %	(5) 30–40 %	(6) 40–50 %	(7) 50–60 %	(8) 60–70 %	(9) 70–80 %	(10) 80–90 %	(11) 90 % and over	(12) Average share of wages in the value of net output	(13) Proportion of Costs of materials in the value of gross output	(14) Proportion of Wages costs in the value of gross output	(15) Proportion of Prime costs in the value of gross output	(16) Proportion of Gross margins in the value of gross output
25–99	4	1·4	1	—	—	—	2	—	—	1	52·3	66·6	17·4	84·1	15·9
100–199	11	9·8	—	1	—	2	3	3	2	—	64·3	65·1	22·4	87·5	12·5
200–299	10	14·2	—	—	—	4	3	1	2	—	65·4	64·2	23·4	87·6	12·4
300–399	9	17·5	—	—	—	5	1	2	1	—	60·3	64·5	21·4	85·9	14·1
400–499	5	13·0	—	—	—	2	2	—	—	1	65·6	65·5	22·6	88·1	11·9
500–749	7	23·8	—	—	—	6	—	1	—	—	57·0	62·4	21·4	83·8	16·2
750 and over	4	20·3	—	—	—	2	1	1	—	—	62·4	66·8	20·2	87·0	13·0
Total	50	100·0	1	1	—	21	12	8	5	2	61·3	64·8	21·5	86·3	13·7

Table 8. *Producers of different types of tinplate products*

(1) Type of product and size group	(2) Costs of materials % gross output	(3) Wages costs % gross output	(4) Prime costs % gross output	(5) Gross margins % gross output	(6) Total gross output	(7) Share of wages in the value of net output
A. *Type of product*						
All units	64·8	21·5	86·3	13·7	100·0	61·3
Blackplate*-producing units	68·6	25·2	93·8	6·2	100·0	80·4
Sheet†-producing units (black, tin or terne)	65·5	18·6	84·1	15·9	100·0	54·0
Terneplate‡-producing units	65·0	25·7	90·7	9·3	100·0	73·6
B. *Size groups*						
100–199 employees						
All units	65·1	22·4	87·5	12·5	100·0	64·3
Tinplate producers only	68·1	17·9	86·0	14·0	100·0	56·0
200–299 employees						
All units	64·2	23·4	87·6	12·4	100·0	65·4
Tinplate producers only	65·8	23·1	88·9	11·1	100·0	67·5
300–399 employees						
All units	64·5	21·4	85·9	14·1	100·0	60·3
Tinplate producers only	64·3	22·6	86·9	13·1	100·0	63·0

* About one-third of blackplates for sale is produced by these firms.

† The bulk of tinned sheets, etc. is produced by these firms.

‡ Over two-thirds of terneplate is produced by these firms.

Table 9. *Cement (units)*

Cols. (4)–(9) show the number of units having varying share of wages in the value of net output

(1) Size group (no. of persons employed)	(2) No. of units in the size group	(3) Weight of the group (proportion of persons employed)	(4) 10–20 %	(5) 20–30 %	(6) 30–40 %	(7) 40–50 %	(8) 50–60 %	(9) 60 % and over
11–49	4	1·4	—	2	[illegible]	1	—	1
50–99	8	8·3	—	2	2	1	1	2
100–199	10	17·2	1	5	—	1	3	—
200 and over	5	73·1	2	2	—	1	—	—
Total	27	100·0	3	11	2	4	4	3

	(10) Average share of wages in the value of net output	(11) Proportion of Costs of materials in the value of gross output	(12) Wages costs	(13) Prime costs	(14) Gross margins
11–49	27·6	59·4	11·2	70·6	29·4
50–99	41·2	53·8	19·0	72·8	27·2
100–199	29·7	41·5	17·4	58·9	41·1
200 and over	20·5	37·9	12·6	50·5	49·5
Total	22·7	39·8	13·7	53·5	46·5

Table 10. *Cement (establishments)*

(1) Size group (no. of persons employed)	(2) No. of establishments in the group	(3) Weight of the group (proportion of employment in the size group)	(4) Proportion of Costs of materials in the value of gross output	(5) Wages costs	(6) Prime costs	(7) Gross margins	(8) Average share of wages in the value of net output
11–49	8	2·2	51·4	15·5	66·9	33·1	31·0
50–99	13	13·2	47·5	16·5	64·0	36·0	31·1
100–199	15	26·0	40·9	15·6	56·5	43·5	26·5
200–749	11	58·5	37·5	12·5	50·0	50·0	19·9
Total	47	100·0	39·8	13·7	53·5	46·5	22·7

Table 11. *Biscuits*

Cols. (4)–(10) show the number of units having varying share of wages in the value of net output

(1) Size group (no. of persons employed)	(2) No. of units in the size group	(3) Weight of the group (proportion of persons employed)	(4) Under 10 %	(5) 10–20 %	(6) 20–30 %	(7) 30–40 %	(8) 40–50 %	(9) 50–60 %	(10) 60 % and over	(11) Average share of wages in the value of net output	(12) Proportion of: Costs of materials in the value of gross output	(13) Proportion of: Wages costs in the value of gross output	(14) Proportion of: Prime costs in the value of gross output	(15) Proportion of: Gross margins in the value of gross output
11–49	9	0·7	—	1	2	5	—	—	1	30·0	40·0	18·0	58·0	42·0
50–99	8	2·0	1	1	4	2	—	—	—	19·4	39·9	11·7	51·6	48·4
100–199	12	5·6	—	—	—	5	4	—	3	42·7	56·2	18·7	74·9	25·1
200–299	6	4·7	—	—	1	3	1	1	—	37·2	53·5	17·3	70·8	29·2
300–499	8	10·0	—	—	4	1	2	—	1	31·5	55·0	14·1	69·1	30·9
500–999	5	11·0	—	—	1	1	3	—	—	34·8	56·1	15·3	71·4	28·6
1000 and over	10	66·0	—	—	1	4	5	—	—	37·2	41·0	22·0	63·0	37·0
Total	58	100·0	1	2	13	21	15	1	5	36·0	45·8	19·5	65·3	34·7

Table 12. *Margarine and Butter*

Cols. (4)–(10) show the number of units having varying share of wages in the value of net output

(1) Size group (no. of persons employed)	(2) No. of units in the size group	(3) Weight of the group (proportion of persons employed)	(4) Under 10 %	(5) 10–20 %	(6) 20–30 %	(7) 30–40 %	(8) 40–50 %	(9) 50–60 %	(10) 60 % and over	(11) Average share of wages in the value of net output	(12) Proportion of: Costs of materials in the value of gross output	(13) Proportion of: Wages costs in the value of gross output	(14) Proportion of: Prime costs in the value of gross output	(15) Proportion of: Gross margins in the value of gross output
Margarine														
100–499	6	22·7	—	4	1	—	—	—	1	17·0	71·2	4·9	76·1	23·9
500 and over*	2	77·3	1	1	—	—	—	—	—	10·6	55·7	4·7	60·4	39·6
Total	8	100·0	1	5	1	—	—	—	1	11·8	59·6	4·7	64·3	35·7
Butter (including both creameries and blended-butter producers)														
11–24	7	5·7	—	2	1	2	1	1	—	27·9	84·2	4·4	88·6	11·4
25–49	6	8·1	—	1	1	1	—	—	3	41·4	91·5	3·5	94·0	6·0
50–199	5	20·2	—	2	1	—	—	1	1	26·3	87·8	3·2	91·0	9·0
200 and over	3	66·0	—	1	—	1	1	—	—	34·3	84·1	5·4	89·5	10·5
Total	21	100·0	—	6	3	4	2	2	4	32·4	85·8	4·6	90·4	9·6

* The firms included in this size group have authorized the Board of Trade to supply for the purpose of the present inquiry the information which relates to this size group.

Table 13. *Producers of different types of butter*

Size group (no. of persons employed)	No. of units in group	The proportion of					No. of persons employed	No. of persons employed %
		Costs of materials	Wages	Prime costs	Gross margins	Gross output		
		in the value of gross output						
				A. Creameries				
Less than 25	3	73·5	7·9	81·4	18·6	100·0	41	2·0
More than 25	3	87·2	3·9	91·1	8·9	100·0	204	10·0
Total	6	86·2	4·2	90·4	9·6	100·0	245	12·0
				B. Blended-butter producers				
11–24	4	88·1	4·4	92·5	7·5	100·0	43	2·1
25–49	4	92·3	2·4	94·7	5·3	100·0	116	5·7
50–199	4	88·5	2·7	91·2	8·8	100·0	220	10·8
200 and over	3	84·1	5·4	89·5	10·5	100·0	1421	69·4
Total	15	85·7	4·3	90·0	10·0	100·0	1800	88·0
Grand total	21	85·7	4·3	90·0	10·0	100·0	2045	100·0

Table 14. *Sugar*

Cols. (4)–(9) show the number of units having varying share of wages in the value of net output

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Size group	No. of units in the size group	Weight of the group (proportion of persons employed)	10–20 %	20–30 %	30–40 %	40–50 %	50–60 %	60 % and over	Average share of wages in the value of net output	Proportion of				
										Costs of materials	Indirect taxes	Wages costs	Prime costs	Gross margins
										in the value of gross output				
(1) Factories mainly using home-grown beet sugar*	14	29	—	—	—	—	—	—	71·5	85·5	7·0	5·4	97·9	2·1
(2) Other sugar factories:														
Medium firms	5	14	—	—	3	—	2	—	37·8	88·7	—	4·3	93·0	7·0
Big firms	3	57	—	—	—	—	3	—	57·4	84·7	5·8	5·4	95·9	4·1

* Subsidies were included in the value of gross output and of net output; they amount to 15·8 % of the value of gross output. Indirect taxes were excluded from the value of net output.

Table 15. *Wallpaper*

Cols. (4)–(12) show the number of units having varying share of wages in the value of net output

(1) Size group (no. of persons employed)	(2) No. of firms in the size group	(3) Weight of the group (proportion of persons employed)	(4) Under 10%	(5) 10–20 %	(6) 20–30 %	(7) 30–40 %	(8) 40–50 %	(9) 50–60 %	(10) 60–70 %	(11) 70–80 %	(12) 80–90 % or over	(13) Average share of wages in the value of net output	(14) Proportion of Costs of materials in the value of gross output	(15) Wages costs	(16) Prime costs	(17) Gross margin
11–49	6	2·3	—	1	—	—	1	1 ▦	—	1	2	57·3	58·2	24·0	82·2	17·8
50–99	4	5·7	—	1	1	▦	1	—	1	—	—	50·4	57·9	21·2	79·1	20·9
100–199	7	18·3	—	1	▦3▦	2	1	—	—	—	—	24·7	41·1	14·6	55·7	44·3
200 and over	10	73·7	—	1	4 ▦	5	—	—	—	—	—	28·2	37·1	17·7	54·8	45·2
Total	27	100·0	—	4	8	▦7▦	3	1	1	1	2	27·7	38·1	17·7	55·8	44·2

Table 16. *Copper and Brass*

Cols. (4)–(11) show the number of units having varying share of wages in the value of net output

(1) Size group (no. of persons employed)	(2) No. of units in the size group	(3) Weight of the group (proportion of persons employed)	(4) 10–20 %	(5) 20–30 %	(6) 30–40 %	(7) 40–50 %	(8) 50–60 %	(9) 60–70 %	(10) 70–80 %	(11) 80 % and over	(12) Average share of wages in the value of net output	(13) Proportion of Costs of materials in the value of gross output	(14) Wages costs	(15) Prime costs	(16) Gros margi
11–24	36	3·3	2	4	1	3	▦9▦	9	1	7	48·8	60·2	19·4	79·6	20·
25–49	24	4·7	—	—	2	4	6 ▦	5	2	5	60·0	64·9	21·0	85·9	14·1
50–99	22	8·0	—	2	3	3	3 ▦	6	2	3	49·1	69·7	14·9	84·6	15·
100–199	10	7·5	—	—	—	5 ▦	4	1	—	—	51·2	65·2	17·8	83·0	17·
200–299	6	8·1	—	1	—	1	1 ▦	—	3	—	55·0	72·5	15·1	87·6	12·
300–499	5	8·8	—	—	1	—	▦2 ▦	—	2	—	56·1	70·5	16·6	87·1	12·
500 and over	9	59·6	—	—	1	▦4▦	3	—	1	—	47·6	65·9	16·2	82·1	17·
Total	112	100·0	2	7	8	20	▦28▦	21	11	15	49·7	66·9	16·5	83·4	16·

Table 17. *Shipbuilding*

Cols. (4)–(11) show the number of units having varying share of wages in the value of net output

(1) Size group (no. of persons employed)	(2) No. of units in the size group	(3) Weight of the group (proportion of persons employed)	(4) Under 30 %	(5) 30–40 %	(6) 40–50 %	(7) 50–60 %	(8) 60–70 %	(9) 70–80 %	(10) 80–90 %	(11) 90 % and over	(12) Average share of wages in the value of net output	(13) Proportion of: Costs of materials	(14) Wages costs	(15) Prime costs	(16) Gross margins
												in the value of gross output			
11–24	18	0·6	—	1	4	4 ▦	3	1	1	4	62·0	32·9	41·6	74·5	25·5
25–49	37	2·4	—	1	3	7	7	▦11▦	2	6	65·9	43·5	37·2	80·7	19·3
50–99	34	5·0	1	—	4	9	▦6▦	3	5	6	65·1	40·1	39·0	79·1	20·9
100–199	31	8·9	1	1	2	1	7	▦9▦	1	9	67·2	43·1	38·2	81·3	18·7
200–299	17	8·2	—	—	1	1	4	2	▦5▦	4	75·7	42·4	43·6	86·0	14·0
300–399	5	3·5	—	—	—	▦3▦	1	—	—	1	61·8	36·4	39·3	75·7	24·3
400–499	8	6·8	—	—	—	2	2	▦	2	2	71·6	50·1	35·7	85·8	14·2
500–749	5	6·0	—	1	—	—	1	▦1▦	1	1	63·3	58·4	26·4	84·8	15·2
750–999	5	8·4	—	—	—	2	—	▦2▦	1	—	66·5	58·6	27·6	86·2	13·8
1000–1999	7	16·0	—	1	—	1	▦2▦	1	1	1	65·0	61·8	24·8	86·6	13·4
2000 and over	6	34·2	—	—	1	2 ▦	1	1	1	—	56·5	60·9	22·1	83·0	17·0
Total	173	100·0	2	5	15	32	▦34▦	31	20	34	63·2	56·2	27·7	83·9	16·1

Table 18. *Seed-crushing*

Cols. (4)–(12) show the number of units having varying share of wages in the value of net output

(1) Size group (no. of persons employed)	(2) No. of units in the size group	(3) Weight of the group (proportion of persons employed)	(4) Under 10 %	(5) 10–20 %	(6) 20–30 %	(7) 30–40 %	(8) 40–50 %	(9) 50–60 %	(10) 60–70 %	(11) 70–80 %	(12) 80–90 % or over	(13) Average share of wages in the value of net output	(14) Proportion of: Costs of materials	(15) Wages costs	(16) Prime costs	(17) Gross margin
													in the value of gross output			
11–49	4	1·2	—	—	—	1	1	▦	1	—	1	51·9	87·2	6·6	93·8	6·2
50–99	4	3·0	—	—	1	—	1	▦	2	—	—	41·5	84·8	6·3	91·1	8·9
100–199	9	13·6	—	—	—	3	▦4▦	1	1	—	—	43·1	82·4	7·6	90·0	10·0
200–399	6	17·8	—	1	—	▦3▦	2	—	—	—	—	29·6	80·8	5·7	86·5	13·5
400 and over	6	64·4	—	1	1	▦3▦	1	—	—	—	—	31·0	78·8	6·6	85·4	14·6
Total	29	100·0	—	2	2	10	▦9▦	1	4	—	1	32·2	79·7	6·5	86·2	13·8

Table 19. *Starch and Polishes*

Cols. (4)–(12) show the number of units having varying share of wages in the value of net output

(1) Size group (no. of persons employed)	(2) No. of units in the size group	(3) Weight of the group (proportion of persons employed)	(4) Under 10 %	(5) 10–20 %	(6) 20–30 %	(7) 30–40 %	(8) 40–50 %	(9) 50–60 %	(10) 60–70 %	(11) 70–80 %	(12) 80–90 % or over	(13) Average share of wages in the value of net output	(14) Proportion of Costs of materials in the value of gross output	(15) Wages costs	(16) Prime costs	(17) Gross margi
11–24	7	1·7	1	4	1	—	—	1	—	—	—	16·2	45·6	8·8	54·4	45·6
25–49	13	7·0	4	2	1	1	2	1	—	—	2	21·4	56·6	9·3	65·9	34·1
50–99	8	7·7	3	1	3	1	—	—	—	—	—	12·2	39·9	7·3	47·2	52·8
100–399	9	19·1	—	7	—	—	2	—	—	—	—	18·1	46·4	9·7	56·1	43·9
400 and over	3	64·5	1	—	1	1	—	—	—	—	—	17·5	31·5	12·0	43·5	56·5
Total	40	100·0	9	14	6	3	4	2	—	—	2	17·4	37·2	10·9	48·1	51·9

Table 20. *Fertilizers*

Cols. (4)–(11) show the number of units having varying share of wages in the value of net output

(1) Size group (no. of persons employed)	(2) No. of units in the size group	(3) Weight of the group (proportion of persons employed)	(4) Under 10 %	(5) 10–20 %	(6) 20–30 %	(7) 30–40 %	(8) 40–50 %	(9) 50–60 %	(10) 60–70 %	(11) 70 % and over	(12) Average share of wages in the value of net output	(13) Proportion of Costs of materials in the value of gross output	(14) Wages costs	(15) Prime costs	(16) Gross margi
11–24	30	8·6	—	5	10	4	2	3	—	6	35·2	65·4	12·2	77·6	22·4
25–49	26	14·5	1	8	7	2	3	3	1	1	24·8	57·6	10·5	68·1	31·9
50–99	19	19·8	2	3	2	3	4	2	1	2	25·0	56·0	11·0	67·0	33·0
100–199	17	36·1	1	1	4	5	5	—	—	1	29·3	56·5	12·8	69·3	30·7
200 and over	5	21·0	—	—	2	—	3	—	—	—	34·1	61·5	13·1	74·6	25·4
Total	97	100·0	4	17	25	14	17	8	2	10	28·9	58·3	12·1	70·4	29·6

Table 21. *Cotton-spinning*

Cols. (4)–(15) show the number of units having varying share of wages in the value of net output

(1) Size group (no. of persons employed)	(2) No. of units in the size group	(3) Weight of the group (proportion of persons employed)	(4) 10–20 %	(5) 20–30 %	(6) 30–40 %	(7) 40–50 %	(8) 50–60 %
11–24	28	0·5	—	2	4	5	4
25–49	45	1·5	—	1	4	3	10
50–99	63	4·3	1	—	5	3	7
100–199	94	12·6	—	2	1	8	15
200–299	106	23·4	—	—	—	2	6
300–399	49	15·4	—	—	1	—	4
400–499	37	15·2	—	—	—	—	5
500–749	22	12·3	1	—	2	—	2
750–999	14	10·5	—	—	—	1	1
1000 or more persons	4	4·3	—	—	—	1	1
Total	462	100·0	2	5	17	23	55

	(9) 60–70 %	(10) 70–80 %	(11) 80–90 %	(12) 90–100 %	(13) 100–200 %	(14) 200–300 %	(15) 300 % and over
11–24	2	3	1	—	6	—	1
25–49	9	5	4	5	4	—	—
50–99	11	10	12	8	6	—	—
100–199	13	19	13	12	11	—	—
200–299	15	21	30	15	17	—	—
300–399	8	16	12	6	2	—	—
400–499	7	8	8	5	3	1	—
500–749	4	10	2	—	1	—	—
750–999	4	3	4	1	—	—	—
1000 or more persons	1	—	—	—	1	—	—
Total	74	95	86	52	51	1	1

	(16) Average share of wages in the value of net output	(17) Proportion of Costs of materials in the value of gross output	(18) Proportion of Prime costs in the value of gross output	(19) Proportion of Wages costs in the value of gross output	(20) Proportion of Gross margins in the value of gross output
11–24	55·8	71·0	16·6	87·6	12·4
25–49	60·5	69·8	17·9	87·7	12·3
50–99	64·6	73·1	18·0	91·1	8·9
100–199	70·0	74·6	18·1	92·7	7·3
200–299	79·7	76·1	18·6	94·7	5·3
300–399	75·0	74·0	18·6	92·6	7·4
400–499	76·1	74·4	19·4	93·8	6·2
500–749	59·8	67·8	18·7	86·5	13·5
750–999	69·6	68·7	22·9	91·6	8·4
1000 or more persons	60·1	77·4	9·8	87·2	12·8
Total	71·4	73·9	18·6	92·5	7·5

Table 22. *Jute*

Cols. (4)–(10) show the number of units having varying share of wages in the value of net output

(1) Size group (no. of persons employed)	(2) No. of units in the size group	(3) Weight of the group (proportion of persons employed)	(4) 30–40 % (or less)	(5) 40–50 %	(6) 50–60 %	(7) 60–70 %	(8) 70–80 %
11–99	7	2·1	2	—	1	1	2
100–199	16	11·9	—	—	2	10	4
200–299	15	16·7	—	1	4	5	2
300–399	8	12·8	—	—	1	1	5
400 and over	11	56·5	—	2	1	2	1
Total	57	100·0	2	3	9	19	14

	(9) 80–90 %	(10) 90 % and over	(11) Average share of wages in the value of net output	(12) Proportion of: Costs of materials in the value of gross output	(13) Wages costs	(14) Prime costs	(15) Gross margins
11–99	1	—	62·4	64·3	22·2	86·5	13·5
100–199	—	—	66·4	66·0	22·6	88·6	11·4
200–299	1	2	66·2	66·1	22·4	88·5	11·5
300–399	—	1	72·4	66·7	24·1	90·8	9·2
400 and over	3	2	70·5	60·2	28·0	88·2	11·8
Total	5	5	69·0	63·0	25·5	88·5	11·5

Table 23. *Breweries**

(1) Size group (no. of persons employed)	(2) No. of units in the size group	(3) Weight of the group (proportion of persons employed)	(4) Average share of wages in the value of net output	(5) Proportion of: Costs of materials in the value of gross output	(6) Indirect taxes	(7) Wages costs	(8) Prime costs	(9) Gross margins
11–24	38	2·1	26·8	32·4	45·2	6·0	83·6	16·4
25–49	59	7·0	17·2	26·9	45·2	3·1	75·2	24·8
50–99	70	14·8	16·4	22·1	45·2	5·4	72·7	27·3
100–199	43	18·3	13·4	17·6	45·2	5·0	67·8	32·2
200–299	13	9·9	11·4	14·8	45·2	4·6	64·6	35·4
300–499	5	5·6	13·4	18·2	45·2	4·9	68·3	31·7
500–749	9	16·6	13·7	13·8	45·2	5·6	64·6	35·4
750 and over	5	25·7	17·2	16·2	45·2	6·6	68·0	32·0
Total	242	100·0	15·0	17·6	45·2	5·5	68·3	31·7

* It was assumed that the proportion of indirect taxes in the value of net output is identical for all size groups with the proportion of indirect taxes in the total value of net output.

Table 24. *Spirit distilling*

Cols. (4)–(11) show the number of units having varying share of wages in the value of net output

(1) Size group (no. of persons employed)	(2) No. of units in the size group	(3) Weight of the group (proportion of persons employed)	(4) Under 10 %	(5) 10–20 %	(6) 20–30 %	(7) 30–40 %	(8) 40–50 %	(9) 50–60 %	(10) 60–70 %	(11) 70 % and over	(12) Average share of wages in the value of net output	(13) Proportion of	(14)	(15)	(16)
												Costs of materials	Wages costs	Prime costs	Gross margins
												in the value of gross output			
11–99	25	22·4	1	10	13	1	—	—	—	—	17·2	54·3	7·8	62·1	37·9
100 and over	13	77·6	3	4	2	—	4	—	—	—	17·9	50·6	8·8	59·4	40·6
Total	38	100·0	4	14	15	1	4	—	—	—	17·7	51·4	8·6	60·0	40·0

Table 25. *Tobacco*

Cols. (4)–(11) show the number of units having varying share of wages in the value of net output

(1) Size group (no. of persons employed)	(2) No. of units in the size group	(3) Weight of the group (proportion of persons employed)	(4) Under 10 %	(5) 10–20 %	(6) 20–30 %	(7) 30–40 %	(8) 40–50 %	(9) 50–60 %	(10) 60–70 %	(11) 70 % and over	(12) Average share of wages in the value of net output	(13) Proportion of	(14)	(15)	(16)
												Costs of materials	Wages costs	Prime costs	Gross margins
												in the value of gross output			
11–24	13	0·6	—	4	—	5	—	—	1	3	33·8	79·2	7·0	86·2	13·8
25–49	14	1·4	—	—	4	4	3	2	1	—	23·3	78·5	5·0	83·5	16·5
50–99	14	2·9	—	1	1	3	1	6	2	—	35·8	66·0	12·2	78·2	21·8
100–199	11	4·3	—	2	2	3	1	1	2	—	36·0	77·0	8·3	85·3	14·7
200–299	8	5·5	—	—	4	1	—	1	1	1	31·8	81·7	5·8	87·5	12·5
300–499	5	5·4	—	2	2	1	—	—	—	—	18·5	77·6	4·1	81·7	18·3
500–999	8	14·6	1	1	2	2	1	—	1	—	26·2	77·7	5·8	83·5	16·5
1000 and over	6	65·3	—	4	2	—	—	—	—	—	12·8	76·5	3·0	79·5	20·5
Total	79	100·0	1	14	17	19	6	10	8	4	14·9	76·7	3·5	80·2	19·8

Table 26. *Soap*

Cols. (4)–(11) show the number of units having varying share of wages in the value of net output

(1) Size group (no. of persons employed)	(2) No. of units in the size group	(3) Weight of the group (proportion of persons employed)	(4) Under 10 %	(5) 10–20 %	(6) 20–30 %	(7) 30–40 %	(8) 40–50 %	(9) 50–60 %	(10) 60–70 %	(11) 70 % and over	(12) Average share of wages in the value of net output	(13) Proportion of Costs of materials in the value of gross output	(14) Wages costs	(15) Prime costs	(16) Gross margin
11–24	35	4·6	1	11	▦10▦	9	2	—	1	1	34·4	63·6	9·7	73·3	26·7
25–49	31	7·1	2	6	▦10▦	6	2	—	3	2	20·3	58·5	8·4	66·9	33·1
50–99	27	13·8	5	8	▦7▦	5	1	1	—	—	15·2	50·1	7·6	57·7	42·3
100–199	12	13·5	2	4 ▦	4	2	—	—	—	—	16·1	47·1	8·5	55·6	44·4
200–399	7	16·9	2	▦4▦	—	1	—	—	—	—	15·3	47·6	8·0	55·6	44·4
400–499	3	9·7	—	1	—	—	▦1▦	—	1	—	32·7	60·2	13·0	73·2	26·8
500–749	3	13·2	—	1	▦2▦	—	—	—	—	—	19·4	56·4	8·5	64·9	35·1
750 and over	3	21·2	1	▦1▦	—	1	—	—	—	—	19·2	55·9	8·5	64·4	35·6
Total	121	100·0	13	36	▦33▦	24	6	1	5	3	18·5	53·4	8·6	62·0	38·0

Table 27. *Gloves*

Cols. (4)–(10) show the number of units having varying share of wages in the value of net output

(1) Size group (no. of persons employed)	(2) No. of units in the size group	(3) Weight of the group (proportion of persons employed)	(4) 30–40 % (or less)	(5) 40–50 %	(6) 50–60 %	(7) 60–70 %	(8) 70–80 %	(9) 80–90	(10) 90 % and over	(11) Average share of wages in the value of net output	(12) Proportion of Costs of materials in the value of gross output	(13) Wages costs	(14) Prime costs	(15) Gros margi
11–24	13	4·7	—	4	2	▦2▦	1	—	4	63·6	60·4	25·2	85·6	14·4
25–49	8	5·2	2	1	1 ▦	1	1	—	2	61·6	56·2	27·0	83·2	16·8
50–99	15	22·1	3	3	1	▦3▦	3	2	—	51·3	53·3	24·0	77·3	22·7
100 and over	17	68·0	2	1	2	▦6▦	2	3	1	62·6	56·1	27·5	83·6	16·4
Total	53	100·0	7	9	6	▦12▦	7	5	7	59·5	55·5	26·5	82·0	18·(

GROUP ‘B’ TABLES

ELEMENTS OF COSTS PER UNIT OF OUTPUT IN DIFFERENT-SIZED GROUPS

Table 28. *Blast Furnaces*

(1) Size group (no. of persons employed)	(2) No. of units in the group	(3) Weight of the group % (proportion of persons employed)	(4) Share of wages in the value of net output %	(5) Physical output per head in tons of basic pig-iron	(6) Selling price	(7) Costs of materials	(8) Wages costs	(9) Prime costs	(10) Gross margins
					(in £ per ton of basic pig-iron)				
50–99	5	4·5	53·3	288	3·53	2·67	0·46	3·13	0·40
100–199	8	13·2	48·4	614	2·77	2·21	0·27	2·48	0·29
200–299	4	11·3	56·0	440	2·72	2·18	0·30	2·48	0·24
300–399	6	23·4	51·7	645	2·81	2·31	0·26	2·57	0·24
400–499	5	47·6	68·5	464	2·77	2·30	0·32	2·62	0·15
500 and over	2								
All size groups	30	100·0	57·7	513	2·80	2·29	0·30	2·59	0·21

Table 29. *Producers of different types of pig-iron*, 1935

(1) Quality of pig-iron	(2) Output per head in tons	(3) Selling price	(4) Costs of materials	(5) Wages costs	(6) Prime costs	(7) Gross margins
		per unit of output (per ton) in £				
Forge and foundry:						
Units with 50–99 employees (3 units)	282	2·65	1·70	0·44	2·14	0·51
Units with 100 and over employees (4 units)	351	2·96	2·05	0·38	2·43	0·53
Total (7 units)	332	2·88	1·96	0·40	2·36	0·52
Basic:						
Units with less than 300 employees (3 units)	588	2·96	2·47	0·28	2·75	0·21
Units with 300 and over employees (5 units)	594	2·74	2·32	0·27	2·59	0·15
Total (8 units)	593	2·78	2·35	0·27	2·62	0·16
Acid:						
Units with less than 400 employees (3 units)	550	3·19	2·47	0·30	2·77	0·42
Units with over 400 employees (3 units)	338	3·31	2·74	0·43	3·17	0·14
Total (6 units)	411	3·26	2·61	0·37	2·98	0·28

Table 30. *Tinplate*

(1) Size group (no. of persons employed)	(2) No. of units in the group	(3) Weight of the group % (proportion of persons employed)	(4) Share of wages in the value of net output %	(5) Physical output per head in tons of tinplate	(6) Selling price	(7) Costs of materials	(8) Wages costs	(9) Prime costs	(10) Gross margins
					(in £ per ton of tinplate)				
25–99	4	1·4	52·3	38·0	18·70	12·47	3·33	15·80	2·90
100–199	11	9·8	64·3	28·6	20·60	13·40	4·60	18·00	2·60
200–299	10	14·2	65·4	26·5	19·40	12·46	4·54	17·00	2·40
300–399	9	17·5	60·3	33·5	19·30	12·48	4·12	16·60	2·70
400–499	5	13·0	65·6	31·6	19·40	12·71	4·39	17·10	2·30
500–749	7	23·8	57·0	37·5	19·30	11·98	4·12	16·10	3·20
750 and over	4	20·3	62·4	38·2	18·70	12·64	3·76	16·40	2·30
All size groups	50	100·0	61·3	33·7	19·30	12·48	4·15	16·63	2·67

Table 31. *Producers of different types of tinplate products,* 1935 *(in £ per ton)*

(1) Type of product	(2) Selling price (factory)	(3) Costs of materials	(4) Wages costs	(5) Prime costs	(6) Gross margins	(7) Output per head
Product of all units	19·30	12·48	4·15	16·63	2·67	33·7
Size group 100–199 employees:						
All units	20·60	13·40	4·60	18·00	2·60	28·6
Tinplate makers only	21·20	14·40	3·80	18·20	3·00	31·8
Size group 200–299 employees:						
All units	19·40	12·46	4·54	17·00	2·40	26·5
Tinplate makers only	19·60	12·90	4·50	17·40	2·20	27·2
Size group 300–399 employees:						
All units	19·30	12·48	4·12	16·60	2·70	33·5
Tinplate makers only	18·60	12·00	4·20	16·20	2·40	32·5
Blackplate* makers	12·30	8·40	3·10	11·50	0·80	42·5

Source for Tables 29 *and* 31: A sample of individual census returns.

Note. The firms included in the groups are those producing solely or overwhelmingly one or other product. Firms producing more than one product were excluded from these tables.

* About one-third of blackplates for sale is produced by these firms.

Table 32. *Cement (units)*

(1) Size group (no. of persons employed)	(2) No. of units in the group	(3) Weight of the group % (proportion of persons employed)	(4) Share of wages in the value of net output %	(5) Physical output per head in tons of cement	(6) Selling price	(7) Costs of materials	(8) Wages costs	(9) Prime costs	(10) Gross margins
					(in £ per ton of cement)				
11–49	4	1·4	27·7	630·9	1·61	0·97	0·17	1·14	0·47
50–99	7	7·4	41·2	492·5	1·70	0·93	0·31	1·24	0·46
100–199	9	15·2	29·7	504·6	1·53	0·63	0·27	0·90	0·63
200 and over	5	76·0	20·5	721·5	1·45	0·55	0·18	0·73	0·72
All size groups	25	100·0	22·7	667·0	1·48	0·60	0·20	0·80	0·68

Table 33. *Cement (establishments)*

(1) Size group (no. of persons employed)	(2) *a* Weight of group % (proportion of persons employed)	(2) *b* No. of establishments	(3) Share of wages in the value of net output %	(4) Physical output per head in tons of cement	(5) Selling price	(6) Costs of materials	(7) Wages costs	(8) Price costs	(9) Gross margins
					(in £ per ton of cement)				
				A					
11–49	2·4	8	30·0	633	1·41	0·75	0·20	0·95	0·46
50–99	12·7	12	32·3	580	1·61	0·79	0·27	1·06	0·55
100–199	24·9	14	26·7	590	1·41	0·58	0·22	0·80	0·61
200–749	60·0	10	19·8	714	1·48	0·55	0·18	0·73	0·75
Total	100·0	44	22·7	667	1·48	0·60	0·20	0·80	0·68
				B					
11–49	2·4	8	30·0	560	1·59	0·85	0·22	1·07	0·52
50–99	12·7	12	32·6	612	1·52	0·75	0·25	1·00	0·52
100–199	24·9	14	27·2	555	1·50	0·62	0·24	0·87	0·66
200–749	60·0	10	19·7	731	1·45	0·54	0·18	0·72	0·73
Total	100·0	44	22·7	667	1·48	0·60	0·20	0·80	0·68

Note. A. Physical output of single establishments given on one return apportioned on the assumption that physical output per head is the same in all these establishments. B. Physical output of single establishments given on one return apportioned on the assumption that unit price is the same in all these establishments.

Table 34. *Biscuits*

(1) Size groups (no. of persons employed)	(2) No. of units in the group	(3) Weight of group % (proportion of persons employed)	(4) Selling price	(5) Costs of materials	(6) Wages costs	(7) Prime costs	(8) Gross margins	(9) Gross margins as % of selling price	(10) Output per head (cwt.)
			(in £ per cwt. of biscuits)						
(A) Selling price £5–6:									
All units (small and medium units and one big unit)	7	6·6	5·67	2·01	1·30	3·31	2·36	41·6	73
(B) Selling price £4–5:									
All units (big units with 1000 employees and over)	6	43·2	4·68	1·88	1·09	2·97	1·71	36·5	73
(C) Selling price £3–4:									
Units with less than 200 employees	7	3·1	3·49	1·90	0·59	2·49	1·00	28·7	104
Units with 200–499 employees	4	6·5	3·40	1·71	0·63	2·34	1·06	31·1	98
Units with 500 and more employees	3	18·0	3·72	1·67	0·68	2·35	1·37	36·8	96
(D) Selling price £2–3:									
Units with less than 200 employees	5	1·7	2·37	1·13	0·50	1·63	0·74	31·2	131
Units with 200–499 employees	5	6·0	2·21	1·24	0·28	1·52	0·69	31·2	247
Units with more than 500 employees	4	12·4	2·28	1·04	0·38	1·42	0·86	37·7	246
(E) Selling price £1–2:									
All units (small and medium units)	4	2·5	1·81	1·10	0·25	1·35	0·46	25·4	208
(F) Average	45	100·0	3·55	1·53	0·73	2·26	1·29	36·3	104

Table 35. *Margarine*

(1) Size group (no. of persons employed)	(2) No. of units in the group	(3) Weight of the group % (proportion of persons employed)	(4) Share of wages in the value of net output %	(5) Physical output per head in cwt. of margarine	(6) Selling price	(7) Costs of materials	(8) Wages costs	(9) Prime costs	(10) Gross margins
					(in £ per cwt. of margarine)				
100–499	6	30·2	17·0	772·5	1·93	1·37	0·091	1·46	0·47
500 and over*	2	61·8	10·6	1634·9	1·71	0·95	0·081	1·03	0·68
All size groups	8	100·0	11·8	1304·0	1·76	1·05	0·083	1·13	0·63

* The firms included in this size group have authorized the Board of Trade to supply for the purpose of the present inquiry the information which relates to this size group.

Table 36. *Producers of different types of Butter*

(1) Size group (no. of persons employed)	(2) No. of units in the group	(3) Share of wages in the value of net output %	(4) Physical output per head in cwt. of butter	(5) Selling price	(6) Costs of materials	(7) Wages costs	(8) Prime costs	(9) Gross margins
				(in £ per cwt.)				
			A. Creameries					
Less than 25	3	29·8	171·3	5·18	3·80	0·41	4·21	0·97
More than 25	3	30·5	496·3	4·83	4·21	0·19	4·40	0·43
Total	6	30·4	441·9	4·86	4·19	0·20	4·39	0·47
			B. Blended-butter producers					
11–24	4	37·0	397·5	5·38	4·74	0·24	4·98	0·40
25–49	4	31·2	713·2	4·48	4·13	0·11	4·24	0·24
50–199	4	23·5	661·1	4·76	4·21	0·13	4·34	0·42
200 and over	3	34·3	257·0	5·63	4·70	0·29	4·99	0·64
Total	15	30·1	339·2	5·26	4·50	0·23	4·73	0·53

Table 37. *Sugar*

(1) Size group	(2) No. of units in the group	(3) Weight of the group % (proportion of persons employed)	(4) Physical output per head	(5) Selling price	(6) Costs of materials	(7) Wages costs	(8) Prime costs*	(9) Gross margins
Refined sugar manufactured from other than home-grown beet (in £ per cwt.)								
Medium firms	5	13·2	4308	0·839	0·739*	0·035	0·774*	0·065
Big firms	3	53·7	3837	0·746	0·632*	0·040	0·672*	0·074
Refined sugar (firms mainly engaged in beet-sugar production) (in £ per cwt.)								
Medium firms	14	26·7	3044	0·719†	0·723*	0·045	0·768*	−0·049†

* Including indirect taxes.

† Excluding subsidies, valued at £0·155 per cwt.

Table 38. *Wallpaper*

(1) Size group (no. of persons employed)	(2) No. of units in the group	(3) Weight of the group % (proportion of persons employed)	(4) Share of wages in the value of net output %	(5) Physical output per head in cwt. of wallpaper	(6) Selling price	(7) Costs of materials	(8) Wages costs	(9) Prime costs	(10) Gross margins
					(in £ per cwt. of wallpaper)				
11–49	5	1·8	57·3	62·9	6·05	2·72	2·18	4·90	1·15
50–99	4	5·9	50·4	222·2	1·85	1·07	0·39	1·46	0·39
100–199	7	18·7	24·7	183·8	2·86	1·17	0·42	1·59	1·27
200 and over	10	73·6	28·2	191·2	2·93	1·09	0·52	1·61	1·32
All size groups	26	100·0	27·7	189·0	2·90	1·10	0·50	1·60	1·30

GROUP 'C' TABLES

ELEMENTS OF COSTS PER UNIT OF OUTPUT OF FIRMS GROUPED ACCORDING TO THE SHARE OF WAGES IN THEIR NET OUTPUT

Table 39. *Blast-furnaces*

(1) Group of units for which the share of wages in net output was found to be	(2) No. of units in the group	(3) Selling price	(4) Costs of materials	(5) Wages costs	(6) Prime costs	(7) Gross margins
		(in £ per ton of basic pig-iron)				
20–40 %	6	3·92	2·49	0·38	2·87	1·05
40–60 %	9	2·89	2·19	0·31	2·50	0·49
60–70 %	3	2·82	2·29	0·34	2·63	0·19
70–80 %	6	2·85	2·36	0·36	2·72	0·13
80 % and over	5	2·72	2·36	0·29	2·65	0·07

Table 40. *Tinplate*

(1) Group of units for which the share of wages in net output was found to be	(2) No. of units in the group	(3) Selling price	(4) Costs of materials	(5) Wages costs	(6) Prime costs	(7) Gross margins
		(in £ per ton of tinplate)				
30–50 %	22	21·8	13·0	4·2	17·2	4·6
60–70 %	12	19·6	12·4	4·6	17·0	2·6
70–80 %	8	18·8	12·4	4·7	17·1	1·7
80 % and over	6	18·1	12·9	4·7	17·6	0·5

Table 41. *Cement*

(1) Group of units for which the share of wages in net output was found to be	(2) No. of units in the group	(3) Selling price	(4) Costs of materials	(5) Wages costs	(6) Prime costs	(7) Gross margins
		(in £ per ton of cement)				
10–20 %	3	1·50	0·46	0·17	0·63	0·87
20–30 %	8	1·44	0·64	0·19	0·83	0·61
30–50 %	6	1·53	0·66	0·33	0·99	0·54
50–60 %	4	1·66	1·02	0·36	1·38	0·28
60 % and over	3	1·93	1·38	0·37	1·75	0·18

Table 42. *Biscuits*

(1) Group of units for which the share of wages in net output was found to be	(2) No. of units in the group	(3) Selling price	(4) Costs of materials	(5) Wages costs	(6) Prime costs	(7) Gross margins
		(in £ per cwt. of biscuits)				
10–30 %	7	4·14	1·47	0·51	1·98	2·16
30–40 %	16	3·56	1·54	0·70	2·24	1·32
40–50 %	9	4·18	2·29	0·90	3·19	0·99
50 % and over	4	3·61	2·13	0·93	3·06	0·55

Table 43. *Butter (including Creameries and Butter-blenders)*

(1) Group of units for which the share of wages in net output was found to be	(2) No. of units in the group	(3) Selling price	(4) Costs of materials	(5) Wages costs	(6) Prime costs	(7) Gross margins
		(in £ per cwt. of butter)				
10–20 %	5	5·11	4·25	0·15	4·40	0·71
20–30 %	3	4·76	4·04	0·19	4·23	0·53
30–40 %	4	5·06	4·08	0·34	4·42	0·54
40–60 %	4	5·39	4·63	0·40	5·03	0·36
60 % and over	3	5·00	4·51	0·34	4·85	0·15

Table 44. *Wallpaper*

(1) Group of units for which the share of wages in net output was found to be	(2) No. of units in the group	(3) Selling price	(4) Costs of materials	(5) Wages costs	(6) Prime costs	(7) Gross margins
		(in £ per cwt. of wallpaper)				
10–30 %	10	2·65	1·04	0·39	1·43	1·22
30–40 %	7	3·30	1·31	0·66	1·97	1·33
40 % and over	5	3·40	1·83	0·80	2·63	0·77

PART III

INTRODUCTION

The significance of the different patterns of the cost structure of individual trades, which were analysed in Part II, becomes clear if these patterns are examined against the background of the general competitive conditions in these trades. We should expect to find different cost structures developing in relation to the different types of producers' organizations, that is, according to whether output is controlled by a small or large number of firms, to whether there is a market-sharing or price-fixing arrangement operating, and so on. Cost structures would also be affected by the type of organization of labour, whether labour is unionized or not, whether wage agreements are made on a national, regional or local basis; or by the type of the product, whether there is one uniform market for all the firms operating in the trade or whether there is widespread product specification so that each producer is supplying a separate market.

The most convenient single index relating to competitive conditions, which is available for all the trades analysed, is the index of concentration of employment in the biggest business units in each trade.

Table 45. *Concentration of employment in the selected trades*

Percentage of all persons employed by the three largest units.

A. Homogeneous trades	%	B. Other trades	%
Wallpaper	90	Seed-crushing	79
Sugar and glucose:		Spirit-distilling	74
Sugar refineries	83	Tobacco	66
Beet-sugar producers	72	Starch and polishes	57
Margarine	72	Soap, candle and perfumery	47
Cement	66	Jute	35
Tinplate	57	Copper and brass	33
Biscuits	37	Shipbuilding	27
Blast furnaces	35	Fertilizers, glue, etc.	25
Butter	22	Cotton-spinning	22
		Gloves	18
		Breweries	16

Source. H. Leak and A. Maizels, 'The structure of British industry', *J. Roy. Statist. Soc.* 1945, Part II.

The degree of concentration of employment in the three biggest units, though important, is obviously not sufficient to give a complete picture of the character of competitive conditions. Therefore, for all the homogeneous trades concerned, we have collected additional material relevant to their organization and structure.*

The most striking fact revealed by this examination is the high degree of concentration of output in the few big firms in almost all the homogeneous trades considered and the widespread existence of all types of imperfect competition in these trades.

Applying such primary tests as control of output by any one firm, influence of one firm's action on prices, and free entry into the trade, we found that in most of the trades chosen monopolistic tendencies prevail. One could find, of course, other homogeneous trades not included in our selection (e.g. cotton-spinning of coarse counts) where competition is relatively free. Nevertheless, it can be stated that homogeneity in itself is no guarantee of free play of competitive forces. On the contrary, the very fact of homogeneity appears to promote the acquisition of control of output by the more powerful units in the trade.

Taking our homogeneous trades (and their subsections) the following types of imperfect competition can be distinguished:

A. Near monopoly (domination of an overwhelming proportion of output by one firm). Examples: margarine, sugar-refining (of foreign raw sugar), wallpaper.

B. Price leadership. Example: cement.

C. Price regulation by Trade Association. Example: pig-iron (basic and acid).

D. Pooling Association. Example: tinplate.

E. Product differentiation by heavy advertising. Example: biscuits.

F. Other types of market imperfection. Example: blended butter.

G. Relatively free markets. Example: creamery butter, some ranges of biscuits, forge and foundry pig-iron (though with wide-reaching specializations of the product).

The more specific characteristics of the individual trades will be made clear in the following chapters which examine the structure and organization of the cement, blast-furnaces and tinplate trades and, in a much shorter form, the structure of the butter and margarine, sugar, biscuits and wallpaper trades also.

These same chapters contain an analysis of the changes in the cost structure through time for all individual trades for which data were available.

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* The lack of reliable information relating to the structure and organization of individual industries is a most important gap in the British economic literature. Apart from the few basic industries (iron and steel, cotton, public utilities, coal), practically no systematic information can be found for any industry. For lack of time, the collection of background material in this study has had to be limited to the homogeneous industries included in this study. The treatment of the single trades in the following chapter has also been largely governed by the availability of information.

CHAPTER IV

PRICES, PRODUCTIVITY AND DISTRIBUTION IN THE BRITISH CEMENT TRADE

I. STRUCTURE AND ORGANIZATION

(i) *General characteristics*

The cement trade is one of the few industries producing almost exclusively one product: Portland cement.* 90 % of the home production is destined for the internal market, which is almost entirely supplied from home production. It is an industry relying exclusively on home-produced raw materials. Cement-making requires heavy capital outlay; capital intensity per unit of capacity is high.

In the last forty years, the industry has experienced a steady expansion, accompanied by a great increase in productive capacity and a spectacular rise in productivity per operative employed.

(ii) *Structure and organization of the producers*

The cement trade is one of the most highly concentrated trades in Britain, and it is an industry in which the number of firms has been declining and concentration has been growing.† In 1935, 66 % of the employment (and 77 % of the value of net output) was controlled by the three biggest business units. Plant concentration has been smaller; in 1935 the five biggest establishments employed 32 % of all persons. The average number of persons employed in establishments (employing more than ten persons) was 157 in 1935, and the average in the five biggest establishments only 654. The biggest business unit in the trade‡ controls a substantial proportion of the output and can be regarded as the price leader. The producers' association is an extremely close one, and new entry into the trade, because of the heavy capital outlay necessary and the resistance of established and well-organized interests, very difficult.§

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* A few firms producing gypsum are classified, however, with the Cement Trade of the *Census*. There are three kinds of cement: Portland, high aluminous cement and slag cement. Portland makes up the overwhelming bulk. In 1940, for example, 150,000 tons of slag cement were produced out of a round 7 million tons. There are two grades of Portland cement: ordinary and ferrocrete or rapid hardening. The latter is produced by the addition of gypsum.

† The number of returns (firms) has declined from 109 in 1924 to 73 in 1930 and 46 in 1935.

‡ The Associated Portland Cement Manufacturers, Ltd., also controlling the British Portland Cement Manufacturers, Ltd.

§ Although, as the history of the last thirty years has shown, newcomers have succeeded in forcing repeated reorganizations of the industry.

(iii) *History of concentration*

The history of concentration in the cement trade is worth recalling. During the last forty years, says *The Economist*,[*] 'on three separate occasions "war" has been ended by a producer's amalgamation, followed by a rise of selling prices, the emergence of new units, the inception and breakdown of voluntary endeavours to secure a common selling policy—and the cycle as before'. Owing to the heavy capital outlay per unit of output there is an incentive among the producers to work at full capacity. This leads to price-cutting and thus provokes a tendency to amalgamation. This process started in 1900. In 1900 the Associated Portland Cement Manufacturers Limited (referred to in this chapter as A.P.C.M.), which is still the leading firm of the industry, was founded to amalgamate twenty-six companies working mainly in the Thames and Medway (Kent) valley. In the next decade, which was a period of technical development, due to the invention and introduction of the rotary kiln, a new group of competitors grew up. In 1911 the A.P.C.M. gained control of thirty-three new companies scattered all over the British Isles, which were merged into the British Portland Cement Manufacturers Limited (B.P.C.M.). The new company became a subsidiary of the A.P.C.M. On the eve of the 1914–18 war, four-fifths of the output of Britain was controlled by the A.P.C.M. group.

After the 1914–18 war, the removal of Government controls was followed by a period of keen competition. With the emergence of new competitors, prices from 1924 onwards showed a steady decline. The occasional agreements made, for example in 1928, to abstain from price-cutting, did not in general last very long. In 1931 the A.P.C.M. purchased the leading interest of one of the competitors, the Red Triangle group.[†] Despite the merger, prices tended to fall, owing to the depression and to economy in public works, until 1934.[‡] In 1934 the producers made a gentleman's agreement providing for price-fixing and also regulating output on a quota basis. The quotas were based on the average output over a period of years and were flexible in that they could be adjusted, if necessary, by a central committee. The first year when the full effect of this agreement became operative was the year 1935, as '1934 had been spent in securing adherence by the smaller concerns and in working off old contracts at the low prices'.[§]

In January 1938 a close agreement and exchange of shares between three leading groups was put into effect. The companies involved were the A.P.C.M. group, controlling 55 % of the output, the Alpha Cement group, controlling 15 % of the output, and the Tunnel Cement group, controlling

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[*] *The Economist*, 8 June 1935, p. 1309. See also ibid. 6 April 1935, p. 817.

[†] The group ran into financial difficulties and was bought up by the A.P.C.M. For details see Political and Economic Planning, *Housing England*, December 1934, pp. 111–16.

[‡] Although imports were not important, the imposition of the tariff may have facilitated the agreement.

[§] *The Economist*, 14 March 1936, p. 596.

12½ % of the output. The exchange of shares was put into effect in such a way that the Alpha group was absorbed by the other two companies.*

(iv) *Organization of labour*

The organization of labour is not as strong as that of the workers in, say, the coal or steel trades. The workers (who are overwhelmingly adult males—about 90 %—the rest being youths, with practically no women) are organized by at least four unions. The process workers, who form the bulk of the men employed in the industry, are catered for by the two general unions. The organization is on a district basis. The National Arbitration Organization set up after the 1914–18 war produced to a certain extent uniform conditions throughout the country; these were, however, restricted to such standard conditions as hours of the working week, overtime payment, holidays with pay, etc. Wages were left to be settled on a district basis.

(v) *Main trends of development*

The trend of cement production is upwards, particularly from 1924 onwards. From 1907 to 1912 there was a small drop, but in 1924 production was slightly above the 1907 level. From then onwards production and consumption went up steadily. This was due to the development of motoring and the subsequent building of new roads. Later on, the extensive public building programme and recently the rearmament boom and then the war gave new impetus.

The main consumers of the cement trade are: builders of residential buildings, who, in normal years, take up one-third of the product; builders of factories and public buildings, public roads, bridges and tunnels. Recently, cement has been used to a certain extent as a substitute for steel or in the form of asbestos cement plates, etc. Practically the whole internal market is supplied by home-produced Portland cement (96·9 % in 1935).

Table 46 summarizes the main trends of development in the cement trade through the last thirty years before the 1939–45 war.

2. COST STRUCTURE. A SURVEY OF ITS MAIN CHANGES

The cost structure of the cement trade is shown in Tables 47–49. Table 48 shows the elements of costs in the value of gross output and in the value of net output in percentages based on the aggregate costs and receipts of the trade. Tables 47 and 49 show (for cement production only, i.e. about 90 % of the output of the cement trade as defined in the *Census*) the elements of costs and prices per unit of output in absolute figures and in indices.

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* See *The Economist*, 1 January 1938, pp. 30–31; also the Report on A.P.C.M.'s General Meeting in *The Economist*, 2 April 1938, p. 54. The Tunnel group received 26 % of the shares of the Alpha group and gave to A.P.C.M. in exchange B′ ordinary non-voting Tunnel shares.

Table 46. *Cement trade: basic data*, 1907–38

	(1)	(2)	(3)	(4)	(5)	(6)
	Estimated capacity '000 tons	Output of cement		Employment in the cement trade		Percentage of insured unemployed
		quantity '000 tons	value £000	Operatives	Salaried	
1907	3,700	2,886	3,448	13,860	959	—
1912	—	2,722	3,134	13,021	—	—
1924	4,250	3,240	6,994	12,450	1,045	7·8
1930	—	5,056	7,799	9,755	1,234	11·6
1935	7,000 (approx.)	5,949	8,791	8,278	1,942	9·2
1938	8,750	7,715	—	—	—	—

Sources. Capacity for 1907 and 1924 is estimated on the basis of *Census Reports* and refers to kiln capacity. For 1935 the estimate is based on A. C. Davis, *Portland Cement*, 1934, and P E P, *Housing England*, 1934. The figure of 8750 thousand tons is the estimate of plant capacity at the outbreak of the 1939–45 war, based on the *Report of the Committee on Cement Production*, Cmd. 6282, 1941.

Output of cement data are based on the *Census Reports*; for 1938 on the *Statistical Year Book of the League of Nations*.

Employment data are based on the *Census Reports*. They refer to the cement trade as a whole, of which cement accounts for only 90 % of the output. Prior to 1930, the data include employment in quarries owned by cement-making firms; for 1930 and onwards, they exclude such employment. For 1930, on this account, employment has been reduced by an estimated number of 2275 persons.

Percentage of insured unemployed in July of each year refers to the insured population in the cement, lime-kiln, etc. trades, and is based on Ministry of Labour statistics.

The development of prices and costs and of distributive shares (between wages and profits) can be analysed for the three periods 1907–24, 1924–30 and 1930–5 separately.

From 1907 *to* 1924 (see Table 47 A)—a period which is influenced by great changes in the general price level—the cost structure of the trade, as we now know it, had not yet emerged clearly. Wages costs, material costs and (thus) prime costs increased by almost exactly the same percentage; selling price per unit increased by more than prime costs per unit, and gross margins more than doubled. Horse-power per worker in this period nearly doubled (most of the old equipment had to be scrapped), while capacity remained almost the same. The increase in productivity was slight. The downward tendency of the share of wages had started, however, already in this period.

From 1924 *to* 1930 (see Table 47 B)—the period of price warfare in the trade—selling prices, at the factory, declined by about 30 %. The decline in wages costs, in material costs and in prime costs per unit of output again ran parallel. It amounted to some 40 %, and thus it was bigger than the decline in selling price. Gross margins were sticky, and the decline per unit of output was extremely small. On the whole, selling price declined *by the absolute amount* of the decline of prime costs, but *not in proportion* to the decline in prime costs. Output per head increased, horse-power per worker again doubled, but capital costs per unit of output, if anything, declined, gross margins per unit hardly changed, and wages costs per unit declined steadily. All these factors led to a sharp decline in the share of wages in net output.

From 1930 *to* 1935 the same tendency as was ascertained for the second period emerges, but, if anything, much more clearly than before. A significant decrease in prime costs (this time caused by a bigger decrease in wages costs and a smaller decrease in material costs) is accompanied by a smaller decrease in selling price and an increase in gross margins. There was a decrease in selling price corresponding broadly to the absolute decrease in prime costs; that is, selling price fell by the same absolute amount but not in the same proportion. Gross margins per unit continued to remain sticky and, in fact, slightly increased.

The great decrease in wages costs per unit of output and the increase in gross margins resulted in a big drop in the share of wages, it being the biggest single drop among the 115 *Census* trades. It is worth while observing that the drop was at first slight. The main fall occurred in 1935 when the new price and quota agreement became fully effective.

As can be seen from Table 48, in 1907 wages costs still amounted to about one-quarter of the value of gross output. They went down gradually to 13·5 % in 1935, while gross margins increased from about 27 to 45·6 %. Costs of materials as a proportion of total gross output declined only from 47·7 % in 1907 to 40·6 % in 1935. Taking the value of net output in 1907, wages costs amounted to almost half, 48·2 %, of net output, in 1924 to 40 % and in 1935 to less than one-quarter, 22·8 %. Social insurance costs, payable by the employers, added very little to total labour costs, being 0·8 % in 1924 and 0·5 % in 1935. Gross margins as a proportion of net output increased from 51·8 % in 1907 to 59·2 % in 1924 and 76·7 % in 1935.

3. CHANGES IN THE MAIN ELEMENTS OF PRICES AND COSTS ANALYSED

(i) *Selling prices (at factory)*

The main conclusion which emerges from the general survey of changes in prices and costs is that selling prices at the factory move with prime costs, that is, prices are adjusted according to changes in costs. There appears to be, however, a tendency to adjust prices to costs in such a way that gross margins either remain, broadly speaking, unaffected or expand. This adjustment, mainly, takes the form of increasing prices in proportion to increased costs, while decreasing prices by the amount of decreased costs; this type of adjustment of prices prevents the effect of improved manufacturing techniques, resulting in lower wages costs and often also in lower material costs per unit, from being truly reflected in the price of the product. From 1924 to 1935, for example, a 110 % increase in output per man-hour and a simultaneous decline of 43 % in material costs, giving altogether a 46 % decline in prime costs, resulted only in a 31·5 % decline in selling prices at factory. On the other hand, from 1934 to 1935 prime costs per unit increased by about 10 %, while prices increased by 17 %, and gross margins per unit expanded by 25 %.

The main cost elements have been determined by the following factors.

(ii) *Wages costs: changes in wage-rates and productivity*

Changes in wages costs have been determined very largely by changes in labour productivity, that is, by decrease in labour requirements per unit of output and to a much smaller extent only by changes (i.e. increases) in wage-rates.

Average output per operative increased very considerably: in the thirty years between 1907 and 1938 it more than trebled. The increase was rather small from 1907 to 1924 (about 32 %), but most remarkable both from 1924 to 1930 and from 1930 to 1935 (49 and 46 % respectively). There was a further 10 % increase from 1935 to 1938.

Estimated output per operative amounted to 277 tons in 1907, 370 tons in 1924, 545 tons in 1930, 793 tons in 1935 and 872 tons in 1938.

The increase in output per man-hour was similar to the increase in output per man. It increased by 50 % between 1907 and 1924; from 1924 to 1935 it doubled; and from 1924 to 1938 it increased by 140 %.

Increasing mechanization and better equipment, in the form of rotary kilns of increasing length, labour-saving machinery, etc., were the main factors leading to increased productivity.*

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* The making of Portland cement consists, broadly speaking, of the following processes: amalgamation of raw materials, i.e. chalk and clay with water; burning the so-called slurry, i.e. the amalgamated mixture; this is followed by grinding the clinkers and drying and packing the product.

The great technical innovation in cement-making was the discovery of the rotary kiln for burning. While the average length of an old fixed kiln was 30 ft., the rotary kilns are by now anything between 40 and 500 ft. As late as 1907 almost two-thirds (63·3 %) of the capacity was in the form of fixed kilns; by 1924 already 90 % of all

In the thirty years under review there has been a vast increase in the amount of mechanical equipment in the industry. This has been due partly to an increase in capacity, partly to an increase in capital intensity. Both factors have been beneficial for labour productivity. Higher capital intensity, that is, more horse-power per unit of capacity, obviously decreases labour requirements; new capacity installed in the form of machines with greater capacity capable of being operated by the same, or even smaller, number of people as before also decreases labour requirements per unit. From 1907 to 1924 both factors have been operating, and capital intensity increased at a greater rate than output per operative. From 1924 to 1930 the rate of increase in capital intensity slowed down, capacity had been substantially expanded and output per head increased considerably. From 1930 onwards further addition of new capacity took place, accompanied by increase in output per head. There is no evidence that capital intensity also expanded.

During the last thirty years before the 1939–45 war there may have been also some improvement in the quality of Portland cement. Another factor, which may have influenced average productivity, was the increasing importance of special cement products, such as quick-hardening cement, which usually require more labour per unit. On both accounts, increase in labour productivity may have been even higher than estimated above.

Under the influence of increased labour productivity, wages costs should have declined by one-third as between 1907 and 1924, and again should have been more than halved between 1924 and 1935.

The other factor affecting wages costs—change in wage-rates—was more important in the first period. There are no direct data relating to wage-rates, but average earnings increased by about 120 % between 1907 and 1924; of this increase only about 20 % indicated a real increase, the rest only reflected the change in the general price level. Hours of work declined by 12 %.

capacity in use, and 84·5 % of all capacity in existence, were rotary kilns. In 1924 55 % of the idle kiln capacity was of the old—very probably obsolete—type. From 1924 onwards the development was towards the production of larger kilns. It appears that the *increase in capacity is closely connected with the use of rotary kilns* in general and with the use of longer kilns in particular.

The other main technical factor was the *introduction of labour-saving devices.* In this respect it appears that such processes as hydraulic drying and conveying the product mechanically for weighing and packing were the main factors. There are no British data available, but American investigations bear out these points. See H. Jerome, *Mechanization in Industry,* New York, 1934, pp. 80 and 246; and for a most detailed investigation of all factors affecting production in the U.S. 'Productivity in the Portland Cement Industry', prepared by A. W. Frazer and L. A. Epstein under the direction of D. Evans, *Monthly Labor Review,* October 1941, pp. 862ff.

From 1924 to 1935 wage-rates increased by about 10 % only, average earnings expanded by 5 %, and average hours worked increased by 4 %.

(iii) *Material costs*

Changes in costs of materials can be almost entirely accounted for by changes in the prices of the raw materials of the trade. The effect of economies in the use of raw materials per unit has been small.

From 1907 to 1924 material costs per unit of output increased by 62 %; in the same period general wholesale prices increased by about 75 %. In the period 1924–35 material costs per unit declined by 43 %, general wholesale prices declined by 36 %, and prices of the specific raw materials of the trade—a more relevant price index*—declined by approximately 38–42 %.

From the available data it is not possible to judge the effect of economies in the use of raw materials per unit on costs. For the 1930–5 period the following estimate has been made of the amount of coal and electricity used per unit of output:

	Coal used tons	Electricity used (purchased electricity only) per ton of cement produced kWh.
1930	0·326	50·6
1935	0·300	63·0

As can be seen from these figures, the economies in the use of raw materials have been small.

(iv) *Gross margins*

In the period 1907–24 the gross margins per unit of output nearly doubled, from £0·32 to £0·63 per ton.

There is little information available as to how the constituent elements of the gross margins changed in this period. There has been a small increase only in the number of salaried persons, but as salaries may have expanded owing to changes in the price level, some part of the increase in gross margins may have been accounted for by higher salary bills per unit. Capital intensity (as measured by available horse-power per unit of capacity) expanded by some 50 %, thus accounting for another part of the increase in gross margins.

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* This index is based on the price change of the following items: coal, electricity, lime, chalk, altogether representing by value about 70 % of all the raw materials of the trade. The following weights—based on the 1935 *Census* and representing the proportionate importance of these items in the total raw material costs of the trade—have been used: coal 36, electricity 15, lime 10, chalk 9. A considerable margin of error is involved in the construction of this index.

In the period 1924–35 gross margins per unit showed very small changes; after some decline, they again increased, and in 1935 they were about 1½ % below the 1924 level. This development of gross margin per unit is remarkable considering the substantial technical progress in the industry, as manifested by the increase in labour productivity, and especially considering the vast increase in capacity. This latter factor implies that overheads and other fixed costs can be spread over a much larger output. A stable gross margin can therefore be accounted for only by an increase in overhead costs proportionately greater than the increase in capacity,* by an increase in capital intensity and thus in increased capital costs per unit or by an expansion of net profits per unit.

In regard to one item, salaries, sufficient information is available. From 1924 to 1935 the number of salaried employees nearly doubled. In 1924 there was, roughly speaking, one salaried to every twelve operatives in the cement trade (excluding quarries). In 1935 there was one salaried employee to every 4·2 operatives. The share of salaries in gross output increased from 2·3 % in 1924 to 3·9 % in 1935, but the increase in the salary bill per unit of product—owing to the great expansion of output—has been relatively small. Salaries per ton of cement amounted to £0·051 in 1924, to £0·045 in 1930 and £0·057 in 1935.

In regard to changes in capital intensity, and consequently in capital costs, an analysis is given below based on the published balance sheets of the leading firm of the trade. In so far as the experience of this firm is typical of the industry as a whole, it appears that the expansion of the industry has been financed largely out of its own resources, mostly by reinvestment of depreciation funds in more productive equipment; consequently, no increase in capital intensity per unit of output appears to have taken place, and thus capital charges, spread over a higher output, may have gone down. A conjectural distribution of gross margins in 1924 and 1935 is given on p. 88.

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* E.g. an increase in the overhead costs due to 'scientific management', etc.

4. CAPITAL INTENSITY, CAPITAL COSTS AND GROSS MARGINS

(i) *Capital intensity of the leading cement-making firm as ascertained from balance sheets*

A rough estimate of the existing capital intensity and of its changes from 1924 to 1935 can be arrived at from the published balance sheets of the leading firm of the cement trade, the A.P.C.M.[*]

This company has two main assets: (*a*) a cement-producing capacity, estimated by trade circles at 2,240,000 tons per annum at the end of 1934; (*b*) the controlling interest in the B.P.C.M. with an estimated capacity of 1,100,000 tons per annum at the end of 1934. In the following estimation we are concerned with the first asset—the cement-producing capacity—only.

At the end of 1924 the book value of the fixed assets and plant of the A.P.C.M. stood at £6·4 millions with an estimated capacity[†] of 1,280,000 tons per annum, at the end of 1934 at £6·2 millions with an estimated capacity of 2,240,000 tons per annum. Thus the book value of the fixed assets and plant was of the order of £5 per ton of cement-making capacity at the end of 1924, and about half of this amount at the end of 1934.[‡]

During the ten-year period 1924–34 the company had written off its plant and fixed assets (in the form of depreciation and sinking fund) by about £4 millions and reinvested again £3·8 millions, with the result that the capacity of the company expanded by nearly 1 million tons of producing capacity. It appears that what the company allowed for depreciation has been beyond the necessities of 'true' depreciation allowances—that is, the amounts needed for the physical replacement of existing assets owing to wear and tear and obsolescence—and contained a large element of net investment, that is, additions to the existing capital. Thus this particular company, by following the conservative policy of writing off about £400,000 each year, succeeded in replacing the old equipment with new and more productive equipment and also in expanding very considerably.

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[*] *See The Economist*, 6 April, 8 June 1935 (pp. 817 and 1309).

[†] The estimate of capacity is based by the trade experts probably on the Chairman's declaration to the effect that in 1924 £100 of fixed assets were represented by 20 tons of productive capacity, while at the end of 1934 £100 of fixed assets represented 36 tons of productive capacity.

[‡] For other firms there are no sufficient details on the changes of capital investment available. But general information available corroborates the evidence given above for 1934. A. C. Davis estimates, for example, that in 1934 the 'capital costs of all factories in the United Kingdom, including all the usual accessories of the business, would approach some £25 millions'. He also states that capacity is less than 7 million tons; thus capital invested per ton of capacity cannot be more than £3·5–3·6 (*Portland Cement*, 1934, p. 22). For three other companies, British Portland Cement, Tunnel Portland Cement and Ketton, capacity data are available. Estimated capital investment 'per ton' of capacity has been in all three cases between £3 and £4, thus near that of the A.P.C.M.

The book value of the existing capacity at the end of 1934—as suggested above—amounted to about £2·4 per ton of cement-making capacity. Of this the cost of the additional £1 million new capacity (paid out of whatever source) has been estimated at £3·8 millions or about £3·8 per ton. For a number of reasons, however, the costs of installing the new capacity, and thus the capital invested per ton, was probably smaller. The main reason is that cement is not the only source of profit for the company. It also operates lime and chalk quarries, it produces other building materials, operates a fleet of barges, etc. The fixed equipment acquired by the company appears to be more extensive than was needed solely and exclusively for the production of cement.* Thus the cost of installing new capacity may not have been more than say £3 per ton.

(ii) *Analysis of constituents of gross margins*

On the assumption that the experience of this company is representative of the industry as a whole, an estimate of the changes of the constituent elements of gross margins can be attempted.

For this purpose we assume the amount of capital invested in 1924 at about £5 per ton of cement-making capacity and at the end of 1934 at about £2·4–3 per ton of cement-making capacity. Taking 4·5–5 % as a normal rate of return on capital, the interest charge can be estimated at about £0·20–0·25 for 1924 and £0·12–0·15 at the end of 1934. Relating the amounts written off for depreciation (£400,000) to the existing capacity—disregarding the fact that part of it may have been net profit used for new investment—estimated depreciation charges amounted to about £0·30 for 1924 and £0·18 at the end of 1934. Salaries per unit have been estimated on p. 84 and gross margins per unit are given on p. 89. On this basis a conjectural analysis of gross

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* As the Chairman of the company stated, the fixed assets of the company include 'large areas of freehold and leasehold properties, having ample reserves of minerals, numerous houses and cottages, they include tugs, lighters, barges and motor lorries and many plants for the manufacture of a variety of building materials'. In addition, 'the future (of the company) has been made secure by the acquisition of further large areas of freehold and leasehold chalk and clay land' (*The Economist*, 4 April 1936).

Table 47

A. *Changes in the cost structure of the cement trade,* 1907–35*

	1907	1912	1924	1930	1933	1934	1935
(1) Selling price (factory)	100	96·6	181·5	129·4	114·3	106·7	124·3
(2) Material costs per unit of output	100	116·2	162·0	100·1	83·7	81·0	91·8
(3) Wages costs per unit of output	100	—	162·2	113·3	91·5	79·6	79·6
(4) Prime costs per unit of output	100	—	163·2	104·6	86·7	81·4	89·0
(5) Gross margins per unit of output	100	—	231·2	196·9	191·1	177·2	222·9
(6) Output per operative	100	110·6	132·3	196·9	235·9	268·4	286·5
(7) Output per man-hour	100	—	150·0	—	—	—	315·0
(8) Average earnings per worker	100	—	220·0	239·0	—	—	232·0
(9) Average hours of work	100	—	88·0	—	—	—	91·0
(10) Horse-power available per operative	100	—	188·5	379·0	—	—	—
(11) Horse-power available per unit of output	100	—	148·6	157·9	—	—	—

B. *Changes in the cost structure of the cement trade,* 1924–35

	1924	1930	1933	1934	1935
(1) Wholesale price	100	76·7	74·6	67·2	66·6
(2) Selling price (factory)	100	71·3	63·0	58·8	68·5
(3) Material costs per unit of output	100	61·7	51·6	49·9	56·6
(4) Wages costs per unit of output	100	71·2	57·3	50·0	50·0
(5) Prime costs per unit of output	100	63·9	53·0	49·7	54·4
(6) Gross margins per unit of output	100	87·0	84·0	78·3	98·5
(7) Output per operative	100	147·3	176·5	200·8	214·3
(8) Output per man-hour	100	—	—	—	210·0
(9) Average earnings per worker	100	108·4	—	—	105·0
(10) Average hours of work	100	—	—	—	103·8
(11) Earnings per man-hour	100	—	—	—	101·2
(12) Horse-power available per operative	100	201·0	—	—	—
(13) Horse-power available per unit of output	100	106·3	—	—	—
(14) Wage rates	100	103·9	—	102·9	109·7

* Rows (1)–(6) are based on Table 49. Indices for 1933–5 in Part A correspond to indices in Part B adjusted by the chain method. Wage-rates, earnings and hours of work are derived from the usual Ministry of Labour and other official publications. Horse-power per unit of output and per operative is estimated on the basis of the horse-power data of the *Census*. For differences between A and B see note to Table 49.

margins per unit of output can be presented as follows (per ton of cement in £):

	1924		1935	
Gross margins (factory value)*	0·69		0·68	
Salaries	0·05		0·06	
Estimated depreciation	0·30	0·64	0·18	0·62
Estimated interest*	0·20–0·25		0·12	
Residue	0·09–0·14		0·32	

* Not allowing for depreciation and interest on the unused portion of capacity on the one hand or for concealed net profits on the other.

Table 48. *Structure of costs in the cement trade*, 1907–35
(*Elements of costs in the value of output*)

(1) Year of Census*	(2) Coverage of data (proportion of trade covered by wages Census) %	(3) Share of trade group in the value of net output of all trades	(4) Elements of costs in the value of gross output: Prime costs: Wages costs	(5) Social insurance costs	(6) Labour costs	(7) Material costs	(8) Indirect taxes	(9) Total prime costs
			as a percentage of the value of gross output					
1907	—	0·3	25·2	—	25·2	47·7	—	72·9
1924	71·2	0·3	22·9	0·4	23·3	42·7	—	66·0
1930†	—	—	22·2	0·3	22·5	37·0	—	59·5
1930	79·4	0·3	18·9	0·3	19·2	41·6	—	60·8
1935	82·6	0·4	13·5	0·3	13·8	40·6	—	54·4

Year of Census*	(10) Elements of costs in the value of gross output: Gross margins: Salary bill	(11) Other components of gross margins	(12) Total gross margins	(13) Elements of costs in the value of net output: Wages costs	(14) Social insurance costs	(15) Labour costs	(16) Salary bill	(17) Gross margins other than salary
	as a percentage of the value of gross output			as a percentage of the value of net output				
1907	27·1		27·1	48·2	—	48·2	51·8	
1924	2·3	31·7	34·0	40·0	0·8	40·8	4·1	55·1
1930†	3·1	37·4	40·5	35·2	0·6	35·8	4·9	59·3
1930	2·9	36·3	39·2	32·8	0·6	33·4	5·1	61·5
1935	3·9	41·7	45·6	22·8	0·5	23·3	6·5	70·2

Sources. Based on *Census of Production* statistics. Wages bill calculated by the grossing up method. Social insurance contributions estimated with the help of social insurance statistics. Salaries estimated with the help of the data collected by Mr Campion and Miss Marley.

* The first three lines refer to the cement trade, *including* quarries owned by cement-making firms; the last two lines are based on data *excluding* such quarries.

† With allowance for changes in the *Census* method in 1930 (see footnote to Table 49).

Table 49. *Structure of costs in the cement trade*, 1907–35. (*Prices and costs per unit of output: £ per ton of Portland cement*)

Year of Census	(1) Selling price (average wholesale)	(2) Selling price (factory)	(3) Wages costs	(4) Social insurance costs (employers' part)	(3)+(4) (5) Labour costs	(6) Material costs	(5)+(6) (7) Prime costs	(2)–(7) (8) Gross margins	(9) Gross margins as percentage of prime costs	(10) Difference between wholesale and factory price in £	(11) Prime costs as percentage of wholesale price	(12) Physical output per head of operative in tons	(13) Share of wages in the value of net output %
(A) 1907	—	1·190	0·300	—	0·300	0·569	0·87	0·32	37	—	—	226	48·2
1912	—	1·150	—	—	—	0·661	—	—	—	—	—	250	—
1924	3·000	2·160	0·487	0·010	0·497	0·922	1·42	0·74	52	0·84	—	299	40·0
1930	2·300	1·540	0·340	0·005	0·345	0·570	0·91	0·63	69	0·76	—	445	35·2
(B) 1907	—	—	—	—	—	—	—	—	—	—	—	—	—
1924	3·000	2·160	0·400	0·009	0·409	1·06	1·47	0·69	47	0·84	50·7	370	36·5
1930	2·300	1·540	0·285	0·005	0·290	0·654	0·94	0·60	64	0·76	40·8	545	32·8
1933	2·238	1·360	0·230	0·004	0·234	0·547	0·78	0·58	74	0·878	34·9	653	28·2
1934	2·017	1·270	0·200	0·004	0·204	0·529	0·73	0·54	74	0·747	36·1	743	27·0
1935	1·997	1·480	0·200	0·004	0·204	0·600	0·80	0·68	85	0·517	40·0	793	22·8

Notes. (A) and (B) are not comparable, as in the case of A quarries owned by cement firms are included in the cement trade; thus in group A wages per unit and gross margins per unit are higher, while cost of materials per unit is lower. In group B wages are lower and gross margins per unit are also lower, as the margin earned on quarry products, etc., is separately recorded (in the mining group). In order to have comparable series of data for the cost structure of the cement trade we have estimated unit costs for 1924 on the assumption that quarries owned by cement firms are excluded; also we have estimated unit costs for 1930 on the assumption that quarries owned by cement firms are included. For the latter purpose the number of employees affected by the exclusion of quarries for 1930 is given in the 1930 *Census Reports*. From this figure—on the basis of data given for the non-metalliferous mines and quarries trade as a whole—the corresponding number of operatives, their wages bill and their net output can be estimated. This gives all the data needed for calculating unit costs on the assumption that quarries owned by cement firms are included in the cement trade for 1930. Once unit costs are available for 1930 by both methods, unit costs for 1924 excluding quarries can be calculated by the usual chain method. There is, however, a further check. For 1924 the 1930 *Census Report* gives the quantities of quarry products included in the cement trade in 1924. Using average prices—as given in the *Annual Reports of the Secretary of Mines*—the gross output in the cement trade on account of quarries can be estimated. Either from this gross output, on the basis of the *Census of Production*, or independently from the *Annual Reports of the Secretary of Mines*, the number of operatives producing this gross output can also be estimated within close margins of error. Once the operatives are known, the 1924 *Census Report* for non-metalliferous quarries enables us to estimate the wages bill and net output of these operatives in 1924, and thus enables us to calculate unit costs, excluding quarries, for 1924 by this second method. The results are very nearly the same as those arrived at for 1924 by the chain method.

Thus the same estimates have been arrived at by two independent methods. The only common element in the two methods is that in both cases the net output per operative for the non-metalliferous mines and quarries trade as a whole is applied to those operatives producing only quarry products for the cement trade, the quarries forming only a sector of the former bigger group. Considering that the net output per operative in the non-metalliferous quarries is about half of the net output of an operative in the cement trade, and that in spite of this net output in the non-metalliferous quarries amounts to about four-fifths of the gross output of the trade (instead of three-fifths as in the cement trade), this average net output seems quite plausible and acceptable. In any case, it is unlikely that net output per head of the cement-quarry products is higher than the net output per head in all non-metalliferous quarries.

Column (1) is from *The Economist*'s British Wholesale Prices lists—the rest is based on *Census of Production* data. Column (4) was compiled with the help of social insurance rates and statistics.

CHAPTER V

PRICES, PRODUCTIVITY AND DISTRIBUTION IN THE BRITISH TINPLATE TRADE*

I. STRUCTURE AND ORGANIZATION

(i) *General characteristics*

In examining the changes in the cost structure of the tinplate trade in the period 1907–37—as well as in analysing the cost structure of different firms in 1935—the main point to consider is that the first continuous strip mill in Britain, established by Richard Thomas and Co., started operations in late 1938. Thus, prior to this date, tinplate in Britain had been produced by plants operating according to the traditional Welsh methods.

In the period 1907–37 the tinplate industry, which was an important export industry, just held its ground. There was a steady upward trend in the tinplate production of the world, owing to the continuous expansion of the canning trade, the main consumer of the tinplate products. In this expansion, however, British industry hardly participated. Britain did not succeed in increasing its exports. What expansion took place was on account of the expansion of the internal market.

Practically the whole industry is situated in one district, South Wales and Monmouthshire; this favoured the organization of producers, which, for most of the period, covered the pooling of supplies, by a quota system of production, and sometimes also the regulation of prices. With a great many small producers the tinplate trade remained to a certain extent competitive. Although entry to the trade was free and the traditional capital equipment relatively inexpensive, the two basic raw materials, tinplate bars and tin, were controlled for the greater part of the period under review by strict cartel agreements, while the costs of carrying the obsolete excess capacity were fixed by the producers' pools. Also the quota system prevented the elimination of the least efficient units. The end of the period found the trade with much redundant capacity and obsolete equipment.

(ii) *The tinplate trade and its products*

The *Census of Production* defines the tinplate trade as 'comprising firms that were engaged wholly or mainly in the manufacture of tinned and terneplates and sheets'; that is, they were engaged in converting tinplate bars into tinned plates by the traditional method.†

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* This chapter was written before plans for setting up the second continuous mill, involving plans for the reorganization of the whole industry, were made public.

† Many of the existing tinplate firms are steel producers themselves. The integration is, however, economic and financial, and not technological. Tendencies on the side of tinplate makers to participate in steel-making (i.e. to purchase pig-iron and roll their

The products of the tinplate trade are as follows:

Blackplates under $\frac{1}{8}$ in. thick. This is an intermediate product. The bulk produced is coated in the same plant and thus converted into tinplate. A small proportion is, however, sold for purposes of adding to stocks, for export or for ultimate use as finished blackplate by the hollow-ware industry.

Tinned plates. This is the main product of the industry.

Tinned sheets. This is a bigger sized tinplate, over 58 by 28 in. It is produced from sheetbar in the sheet mills.

Terneplate. This is a blackplate dipped in a molten bath of tin and lead mixed, the latter amounting to 70–90 %. It does not have the bright lustre of the tinplate, hence its name. It is a cheaper product than tinplate.

Ternesheets. These are a larger sized terneplate.

The structure of production of the tinplate trade hardly changed throughout the period under review. Its general pattern is as follows: about five-sixths of all plates provided for sale are tinned plates, terneplates and sheets, and about one-sixth blackplates. Of the five-sixths the overwhelming proportion, between 94 and 96 %, are tinned plates, between 1 and 2 % are tinned sheets, between 2 and 3 % are terneplates and between 1 and 1·5 % ternesheets.

The main home consumer of tinplate, terneplate and finished blackplate are the hardware, hollow-ware and allied trades. They account for practically the total home supplies of the finished blackplates and about 70–75 % of all tinplate and terneplate. The remainder of tinplate is used by other metal trades, including engineering. Among the different hollow-ware trades in the above 70–75 %, the tinbox and tin-container-making trades account for 62 %, the domestic hollow-ware trade 5 % and the other hollow-ware, etc., trades 5 %. Thus, as in the U.S.A., the bulk of tinplate is used by the tin-container-making trade.

(iii) *Main trends of development*

Table 50 gives basic data summarizing the main trends of development in the tinplate trade throughout the last thirty years before the war.*

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own tinplate bars) were ascertainable from the turn of the century. After the introduction of protection, most of the small tinplate makers using foreign tinplate bars disappeared and were absorbed into bigger firms, and the economic integration between steel-making and tinplate-making increased.

Although the firms and plants, which are covered by the tinplate trade group of the *Census*, produce mainly tinplate and terneplate and sheets, they are also engaged to a certain extent in sheet-making and production of galvanized sheets. Galvanized sheet is treated as a separate trade by the *Census*, and its focal point is in any case in Staffordshire, outside the tinplate-producing region.

* The tinplate industry was attracted into Wales originally by the abundance of iron ore and wood for making charcoal. Later on pig-iron was the attraction and nearness of ports, owing to export orientation.

The industry was established in Britain at the beginning of the eighteenth century. Its great development started, however, only in the seventies of the nineteenth century, with the manufacture and use of steel for tinplate making, stimulated by the great

Table 50. *The tinplate trade: basic data,* 1907–37*

	(1) Estimated capacity '000 tons	(2) Output of all plates	(3)	(4) Employment in the tinplate trade	(5)	(6) Percentage of insured unemployed
		quantity '000 tons	value £000	Operatives	Salaried	
1907	1·050	637	8425	20059	569	—
1912	1·125	767	10370	24904	597	—
1924	—	924	21132	27098	870	2·7
1930	—	858	15520	24414	857	22·4
1933	—	823	13500	22553	853	25·5
1934	—	788	13394	21814	824	27·4
1935	—	773	13663	21164	821	34·1
1937	1·350	988	21105	25206	921	11·7

Sources. (1) The estimates for 1907 and 1924 are based on the *Censuses of Production*, which give for a high percentage of all firms (in terms of output) the number of existing mills and those in operation. Assuming that the use of capacity is the same for those firms not reporting and taking 1000 boxes per week per mill, an estimate of the capacity of the trade can be made. For 1937, see *The Economist*, 9 April 1938, p. 107. (2)–(5) *Census of Production Reports.* (6) Ministry of Labour data collected in July of each year and published in the *Ministry of Labour Gazette.*

* For further data see the *Iron and Steel Industry* (Cmd. 6811), 1946. This document has been published since this chapter was written.

demand for tinplate by the U.S. and, to a lesser extent, by Australia, for their growing canning trades.

Up to 1890 and the introduction of the McKinley tariff in the U.S., Britain was the only world producer, producing about six-sevenths of the world supply. The bulk of British production, over three-quarters, was exported. The rapidly expanding American production meant the loss of the all-important American market for the Welsh producers, and it was a severe blow. As the Balfour Report states:

'it recovered, however, especially with the growth of other markets and to a certain extent by using imported steel and was a flourishing industry before the [1914–18] war'. During the 1914–18 war American productive capacity, which already in 1913 was above British capacity, approximately doubled. America with its vast internal market became the largest world producer, a position which she has kept and strengthened ever since. During the 1914–18 war America exported largely to markets supplied previously from south Wales. After the war, as the Balfour Report states, South Wales made a great effort to reduce costs and cut prices (in 1921) and the export markets were largely recovered.

In the inter-war period a number of countries, such as British India, Italy, Belgium, and later Canada and Japan, some being former customers of Britain, established tinplate-making industries, although they were producing mainly for their home markets. Germany and France exported more than before, but the U.S. and Britain remained the world suppliers, Britain having the larger share. In 1928 the two important tinplate world exporters, Britain and the U.S., made an agreement; this agreement allocated 70 % of total exports to Britain and 30 % to the U.S. The agreement disintegrated in 1931. On 1 July 1934 the International Tinplate Association was established, to be effective for three years. It was then extended until 10 June 1938, when a new agreement, to extend to 30 June 1941, was made. This last agreement

(iv) *Structure of the British tinplate trade*

The producing unit of the trade was the mill, one plant consisting of a number of mills. As the capital cost of a mill was relatively low, their number could be easily increased. Expansion and contraction in the trade took the form of reopening, closing or adding to the number of mills. The industry was thus characterized by a slight increase in the number of mills over the period under review and by a selective operation of plants and mills within the period.

Throughout there was a tendency towards concentration. This, however, took not the form of technological integration, but the acquisition of existing plants, and thus concentration of the trade in fewer hands.*

The existing number of tinplate mills (exclusive of sheet mills) was about

has not been signed, though it has been operative. Through the events of the war it lapsed.

Blackplates did not come under the international tinplate agreement but under the thin-sheet agreement, which was signed only in the middle of 1938. (For quotas see *The Economist*, 24 September 1938, p. 609. See also Hexner, *The International Steel Cartel*, The University of North Carolina Press, 1943, p. 160 and T.N.E.C., *Hearings*, Part 20.)

World production of tinplate expanded in the period 1907–37 (the peak year) from 1,350,000 to 4,268,000 tons, a threefold increase. American production increased in the same period from 515,000 to 2,400,000 tons, an almost fivefold increase; British production (including finished blackplates) increased from 700,000 to 958,000 tons, an increase of 40 % only. British production amounted to 22 % only of the world production in 1937, while it was still 52 % in 1907.

World export never expanded so much as world production, at most it doubled. It was around 800,000 tons before the outbreak of the 1939–45 war, and in the peak year of 1937 there was an export volume of about 1 million tons, of which Britain supplied 47 %.

For Britain the importance of the home market increased from 23·4 % in 1907 to 45·7 % in 1937, and the importance of Empire markets for British exports increased from 23·8 % of all exports in 1910–13 to 51·2 % in 1937. Both comparisons refer to quantities, not values.

British exports did not expand from 1907 to 1937—they amounted to 400,000 tons in 1907 and 460,000 tons in 1937—but home production followed very closely the expansion of world production. In 1907 home consumption of tinplate (exclusive of finished blackplates) amounted to 124,000 tons, in 1937 to 385,000 tons.

* This development is only partly reflected in the *Census of Production* data. They indicate a decrease in the number of returns (firms) from 84 in 1924 to 68 in 1930 and 66 in 1935. The number of establishments (the nearest indication of plant) decreased from 77 in 1930 to 66 in 1935. The *Ministry of Labour Gazette* in the pre-war years each month gave the number of works (plant) and the number of mills in operation throughout the year (on certain weeks in each month). This is, however, more indicative of the cyclical fluctuations of the trade's fortunes than on the main trends. But these statistics indicate also a decrease in both the number of works and the number of mills in operation both absolutely and in relation to the quantity of production.

500 in the thirties,[*] and there was an equal number in early 1942, to which the latest available trade data refer.[†] For 1942 the following picture emerges from the trade directories:[‡]

British tinplate producers[1]

Name of firm	Works (plant)	Tinplate mills	Approx.[2] capacity box per week	Sheet mills
Richard Thomas and subsidiaries	26	202	202,000	17
Baldwin's and subsidiaries	7	58	57,600	—
Briton Ferry Steel Co. Ltd.	8	46	46,000	4
Llanelly Associated Tinplate Companies, Ltd.	5	43	35,000	—
Partridge Jones and John Paton, Ltd.	4	22	22,000	—
Upper Forest and Worcester Steel and Tinplate Works	2	11	17,000	5
Twenty-one other small producers with no (apparent) steel producing capacity, each having 3–10 mills	22	119	119,000	2

[1] Richard Thomas's Ebbw Vale plant is not included in this compilation. The capacity of the new plant is 600,000 tons of strip steel, a part of which however is used only for tinplate making.

[2] Unless there was some other indication, it was assumed that one mill equals 1000 base box weekly capacity (approximately 20 base boxes equal 1 ton).

Disregarding the continuous strip-mill capacity, the traditional tinplate-making capacity is distributed in the following way: Somewhat over half is controlled by two big firms[§] (about two-fifths by one big firm), who are among the ten biggest iron and steel producers of the country. One-quarter is controlled by four medium firms, mainly amalgamations of smaller producers, all of them steel producers themselves on a small scale. The remaining one-quarter of capacity is represented by twenty-one small firms, who are pure producers and have no steel-making capacity. In 1935 the three largest units employed 57 % of all persons and accounted for 61 % of the total value of net output.

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[*] See E. H. Brooks and others, *Monograph of the Tinplate Works in Great Britain*, issued by the Welsh Plate and Sheet Manufacturers' Association, Swansea, 1932.

[†] *Ryland's Directory*, 1942.

[‡] The compilation which follows is mainly based on *Ryland's Directory*, 1942, supplemented by the *Monograph of the Tinplate Works*, quoted above, and other Trade Directories, apart from Ryland's. Data in the *Monograph* suggest that to take one mill's capacity as being equal to 1000 box weekly output is on the whole a satisfactory measurement.

[§] These two firms amalgamated in 1944.

(v) *Organization of the tinplate makers*

The first trade association of the tinplate makers was founded in 1889. The present Association is affiliated to the British Iron and Steel Federation, but it is more independent than most of the other member associations. Prices of tinplate, for example, are not fixed in the same way as most of the other steel products; it remained a domain of the trade itself.

Apart from research* and propaganda, the Association has three main functions, although it has not been in its power to exercise all of them all the time: (*a*) control of output through the pooling scheme; (*b*) control of prices; (*c*) control of the purchase of raw materials, notably steel. The Association has had no control over entry into the trade.

It appears that it was in the field of control of output that the work of the Association was most effective. This control was necessitated by the constantly existing excess capacity, and it took the form of fixing quotas for firms and payments of compensation by those firms who exceeded the quota to others who produced less than their quota.†

The regulation of output and, to a certain extent, the price-fixing scheme as well were in operation from 1927 throughout the inter-war period. The problem of the use of home-produced semi-finished products was taken care of through the tariff.

(vi) *Organization of labour*

Skilled tinplate work in the conventional tinplate trade, as practised in Wales, is a traditional occupation handed down from father to son. For this reason labour is strongly organized, and the labour force was stable throughout the period both in numbers and also in composition.

Trade-union organizations in the industry are very strong. There are also Joint Industrial Councils operating in the trade. The main unions covering the industry are the Iron and Steel Trades Confederation and the Transport and General Workers' Union.

Wages were regulated in the trade, at least throughout the inter-war period, by 'selling price' sliding scale arrangements. They were introduced in 1921 and suspended only in 1940 for the duration of the war in favour of a cost-of-living sliding scale. The operation of this arrangement does not affect changes in the basic rates or even in some special bonuses; it mainly regulates periodic additions to basic rates according to changes in the selling price of the standard product of the trade. It is of considerable importance that the standard product was not tinplate, but tinplate bar. Thus price changes of tinplate bar regulate wage changes in the whole iron- and steel-making process of tinplate making, as wages of blast furnacemen and also of steel makers have been varied according to changes in the selling price of tinplate bar. Maintenance workers are not covered by the arrangement.

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* Research on a very small scale is supported by the Association in collaboration with the South Wales Siemens Steel Association and University College, Swansea. See *Tinplate and Canning in Great Britain*, *Bulletin* No. 1 of the International Tin Research and Development Council, February 1935, pp. 66ff.

† The difficulties of effective organization in a trade with many small producers is illustrated by the history of the Association after the 1914–18 war (see P. Fitzgerald, *Industrial Combination in England*, 1927, pp. 102ff; also the Balfour Report, Part IV, *Survey of Metal Industries*, p. 35).

2. COST STRUCTURE. A SURVEY OF ITS MAIN CHANGES

The cost structure of the tinplate trade is shown in Tables 53 and 54. Table 53 shows the structure of costs as percentage of the value of gross output and of net output, based on aggregate costs and proceeds. Table 54 shows prices and costs per unit of output. The unit is, however, not 1 ton of tinplate, but 1 ton of all tinplate products of the industry, including terneplates and blackplates. The conclusions which follow are, however, not affected by this factor.

Analysing prices and costs per unit of output for the industry as a whole, it is useful to distinguish between two periods, 1907–24 and 1924–37. In the first period, when there was a substantial change in the general level of prices, selling prices at factory increased by 73 %, material costs increased by 59 %, wages costs increased by 111 % and gross margins increased by 147 %. Prime costs advanced more than material costs under the influence of increased wages costs; prices increased more than prime costs, thus allowing an expansion of gross margins. Gross margins expanded the most, then wages costs (accompanied by an almost stable output per head) and the material costs showed least expansion. It is difficult to say how far these changes were due to general increase in prices and how far to other factors.

The price and cost pattern in the second period, 1924–37, differs considerably from the above picture. In this period the increase of material costs was the main factor, determining both changes of prime costs and also changes of selling prices. From 1924 to 1933, prior to the introduction of protection and devaluation, material costs, prime costs and prices were going down, from 1933 to 1937 they were going up. The fluctuation was greatest in the material costs; wages, though following the general trend with a time lag, were showing much less marked changes, and from 1933 onwards were rather declining. Gross margins declined in the 1924–30 period, and from then onwards expanded quite considerably. In 1937 both prices and the main cost elements were below the 1924 level with the exception of gross margins, which were 55 % above that level.

Taking the structure of aggregate costs, the importance of material costs is very great, although declining. They amount to three-fourths and two-thirds of gross output. Wages make up about one-fifth of gross output and prime costs about nine-tenths of gross output. Gross margins amount to from one-twelfth to one-eighth of gross output. On the whole, during the thirty-year period 1907–37, material costs were declining, wages showed a variable tendency, on the whole increasing, prime costs under the impact of material costs declined, while gross margins increased continuously. Salaries remained stagnant; thus the increase in gross margins was not due to increase in salaries.

The increase in gross margins as a proportion of gross output was throughout greater than the increase, if any, in wages as a proportion of gross output, and consequently the share of wages in the value of net output (made up of gross margins and wages) has declined and the share of gross margins in the value of net output increased. Total gross margins increased from 25·6 % in 1907 to 41·6 % in 1937; gross margins less salaries increased from 25·3 % in 1924 to 38·6 % in 1937.*

3. CHANGES IN THE MAIN ELEMENTS OF PRICES AND COSTS ANALYSED

(i) *Selling prices (at factory)*

As can be seen from the general survey of prices and costs, selling prices at factory were moving in the direction of prime costs, that is, prices were invariably adjusted according to changes in costs. This adjustment has taken place, however, in such a way that gross margins have changed little or have even expanded. With one exception (in the period from 1924 to 1930) prices were usually reduced by the full amount, or less, of the reduction in prime costs per unit, and they were increased by the proportion, or more, of the increase in prime costs.

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* For 1935 some fragmentary evidence is available on how far the cost structure of firms producing mainly or exclusively one or the other of the typical products of the trade differs from the general cost structure of all firms. The products chosen are blackplates, terneplates and sheets. No similar data could be computed for tinned plates, but as tinned plates are the main product of the trade, data relating to the subsidiary products will show how far the general picture derived from data for all firms is relevant for tinned plates and how far it is distorted by the inclusion of firms producing the subsidiary products. There is not much difference among the firms so far as material costs are concerned, which make up about two-thirds of the gross output in all cases. Wages costs are, however, a higher proportion in the gross output of both blackplate and terneplate makers, and consequently gross margins make up a lower proportion. Sheet-makers, on the other hand, have higher gross margins and lower wages costs as percentage of gross output than the average for all firms. The lower proportion of gross margin in gross output in the case of blackplates and terneplates can be explained by the fact that these are less finished or cheaper products, and, therefore, the gross margins realized on them are lower. Absolute wages costs (wages costs per unit of output) are of course lower in the case of blackplates or terneplates compared with the average, and gross margins per unit of output are also lower.

As a result selling prices increased by 62 % between 1907 and 1937, and decreased by 7 % between 1924 and 1937, while prime costs increased by 48 %, and decreased by 12 %, and gross margins increased by 284 % (and 55 %).

The main costs elements have been determined by the following factors.

(ii) *Wages costs*

Changes in the wages costs in the 1907–37 period can be explained partly by changes in wage-rates, partly by changes in labour productivity. The importance of the two factors has been almost equal. Wage-rates on the whole increased throughout the period, while labour requirements per unit decreased. The influence of the former factor was greater in the 1907–24 period and wages costs per unit were increasing, while from 1924 to 1937 the influence of labour productivity was greater and wages costs were on the whole declining.

From 1907 to 1924 output per man-hour increased only slightly (by about 10 %), while, in spite of this increase, wages costs per unit more than doubled. This was due to a very considerable increase in wage-rates; the greater part of this increase reflected changes in the price level, while a smaller, but still substantial, part was real increase. There are no data on changes of wage-rates, but average earnings doubled from 1907 to 1924; and actual hours of work declined from 47·8 to 45·8 hours per week.

From 1924 to 1937 wage-rates increased only slightly (by 3 %), while output per man-hour increased by over 20 %. As a result, wages costs per unit declined by 14 %. The economies in wages costs in this period caused by increased labour productivity can be estimated at £0·80 per ton of tinplate products; the decrease in costs of materials amounted to £1·86, the decrease in selling price to £1·53, and the increase in gross margins in the same period to £1·03.

(*a*) *Changes in labour productivity.* Labour productivity (physical output per head) showed very little progress in the period 1907–37. The increase was much below the average increase in all other trades and amounted to 18 % only in thirty years, of which 10 points occurred between 1935 and 1937. There are few data on hours of work. Available data show that labour productivity per man-hour increased from 1907 to 1935 by 24 %. What little evidence is available suggests that years of higher use of capacity mark higher labour productivity, e.g. in 1924. This might indicate that the selective use of certain plants in the depression periods does not mean the use of the most efficient units.

There was some small change in the character of labour in the thirties, namely, the proportion of adult male workers increased; this may account for some part of the increase in productivity. Thus even the small increase might be more apparent than real. No data are available on increases in quality, if any, of the tinplate produced and on potential changes in the distribution of different qualities of product, e.g. in the ratio of primes to wastes or in the ratio of standard sizes and thickness to special sizes, etc. The production structure, that is, the ratio of finished blackplates to tinned plates and of tinned plates to terneplates, as has already been stated, remained fairly constant over the industry as a whole; so that this factor has not influenced changes in productivity.

Physical output per head of operative amounted to 34·6 tons of tinplate products in 1907, 36·4 tons in 1924, 37·2 tons in 1935 and 40·7 tons in 1937.

The small increase in productivity is somewhat surprising in view of the considerable increase in mechanization. There were no major changes in technique in the period 1907–37—at least they were not put into practice in Britain*—but in many respects mechanization was going

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* The traditional Welsh method of converting steel bars (so-called tinplate bars) into tinned plates consists of rolling the steel bar into blackplate, preparing the blackplate for tinning (pickling, cold rolling, annealing) and tinning the blackplates.

The essence of the strip-mill method of production is that it eliminates the production of steel bar altogether. Tinplate is produced by a completely integrated plant, just like any other rolling mill product; the process is continuous and mechanically handled at every stage. The coating itself, although fully mechanized, is not yet part of the continuous process. Technical progress in this respect has been also very considerable in recent years. In one direction it resulted in the introduction of fully automatic tinning machines as used, for example, at Ebbw Vale. In another direction the electrolytic tinning, in contrast to the dipping process, has been perfected, through which the process may eventually become completely continuous.

The continuous strip-mill process was first applied in 1926 by the American Rolling Mill Company (Armco) and was subsequently installed in several other firms on payment of a licence to the above firm. In 1938 about 13 million tons continuous strip-producing capacity was installed in the U.S. at a total cost of $500 million. The continuous cold reduction process as a continuation of continuous hot rolling was introduced in 1931 for the first time. The original demand, which gave the main impetus to the invention, came from the motor-car manufacturing trade, which wanted a steel sheet capable of withstanding a great amount of cold deformation and which had a suitable surface.

By now practically the whole U.S. tinplate-making capacity is represented by continuous strip mills; dipping departments are very largely mechanized, and an increasing though still small proportion (about 10 % in 1943) is tinned by the electrolytic process.

In Britain the continuous strip-mill process was established in the late thirties. The Ebbw Vale plant of Richard Thomas and Co. was eventually completed in 1938 with a yearly capacity of 600,000 tons and at a capital cost of over £10 million. Not all this capacity is used, however, for the production of blackplates for tinning; part on. Thus hot mills became increasingly mechanized in the twenties; also the different stages of tinning became more and more mechanized.* The *Census of Production* figures show an increase of 48 % in horse-power per operative employed between 1907 and 1930 and a 27 % increase between 1924 and 1930. The increase in available horse-power per unit of output was somewhat smaller, 34 and 23 % respectively, but still significant.†

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of it is used for the production of other types of sheet metal. The other continuous strip mill, nearly completed before the war on the premises of John Summers and Co. at Shotton, is not engaged in tinplate production at all. It was built on a bank overdraft which was replaced by new capital put in by United Steel and the Bankers' Industrial Development Co. Ltd.

The advantages of the continuous strip-mill process in respect of both costs of production and better quality are proved without any doubt. Its main advantages appear to be as follows:

(i) The old product was irregular both in length and width. With the new process it is easy to produce any required width and size, which is especially important now since high-speed automatic machines are used in can-making. It also means a great saving of waste steel.

(ii) In the old process the material was heated at least four times; by the new method it is heated only once. By heating, steel became oxidized; the oxidation was then rolled into the steel and had to be removed by sulphuric acid. This was another source of waste. The new process gives uniformity in material structure and better surface.

(iii) The better surface allows the use of less tin per box of tinplate, say 1·35 lb. instead of, say, 1·50 lb. and, in spite of this, gives a more uniform coating.

(iv) The production of more regular sizes reduces loss and damage in packing.

(v) The most important factor is, of course, the reduction in labour requirements per unit.

The advantages of the electrolytic tinning process, promoted by wartime shortages of tin, are not yet decisively proved. It means, of course, great saving in the amount of tin used; the saving is quite substantial, as the amount needed may not be more than one-third of what is used by the dipping process. For packing dried foodstuffs, etc., this lighter tinning appears to be satisfactory, for other foodstuff heavier tinning may be necessary. But the advantage of electrolytic tinning, if eventually developed and universally adopted, will make tinning part of the continuous process, which now stops short of dipping. In this way, the final tinplate product could be produced in coils to the very great advantage of the tin-container producers using automatic machines.

For the description of the two methods and of the Ebbw Vale plant, see Welsh Reconstruction Advisory Council, *First Interim Report*, 1944, pp. 52, 53; *Tinplate and Canning in Great Britain*, op. cit. pp. 73–5; 'Tin and its uses', *Bulletin of the Tin Research Institute*, no. 1, April 1939 and passim; also T.N.E.C., *Hearings*, Part 19, Hearings of Mr Hook.

* The Thomas and Davies combined pickling, swilling, tinning and cleaning machine was, for example, invented in 1916.

† Horse-power per operative and also per unit of output is much smaller in the tinplate trade than in the iron and steel smelting and rolling trade in general. In 1930 available horse-power in the tinplate industry amounted to 5·11 per operative and 145·4 per 1000 units of output, while in iron and steel smelting and rolling, including blast furnaces, the figures were 18·2 and 329 respectively. The difference

(*b*) *Changes in wage-rates.* Wage-rates in the tinplate trade, at least in the inter-war period, were regulated according to sliding scale arrangements, dependent on changes of the realized prices of Welsh tinplate bars. Basic rates, as explained previously, were not affected, but only additions to the basic rate. For this reason wage-rates exhibited a much smaller degree of fluctuation than tinplate bar prices. This is shown in the table given below:

	Tinplate bar prices ('quoted' prices)	Wage-rates
1924	100	100
1930	69	97
1933	58	90
1934	61	90
1935	62	93
1937	87	103

Changes in wage-rates in the tinplate trade were more favourable than changes in wage-rates in industry as a whole, which is, just as in the blast-furnaces trade, a consequence of the 'price' sliding scale arrangement.

Average earnings followed largely the same course as wage-rates, though the effects of working shorter hours owing to excess capacity has also influenced earnings. In 1935 compared with 1924 average earnings were at a lower level than average wage-rates; earnings per man-hour remained unchanged.

(iii) *Material costs*

Raw-material costs make up a very high percentage of total costs of tinplate products; they have had also a profound influence on the course of prime costs and prices at least in the period 1924–37.

The two main raw materials of the tinplate trade are steel, that is, tinplate bars, and tin. Other raw materials are fuel, packing boxes and a number of small items. Well over half of all material costs consists of the costs of steel (56·4 % in 1937, adding up costs of tinplate bars and sheet bars). About one-fifth of material costs is the cost of tin. The other main items are fuel and electricity 7 % in 1937, boxes 2·8 % in

cannot be interpreted easily, as it is caused partly by the heavy weight which is constantly moved in the iron and steel smelting and rolling trade and also by the fact that tinplate-making really covers two (or rather three) stages of production (hot rolling, cold rolling and coating), while steel smelting and rolling covers a number of stages from blast furnaces to the different finishing stages. All the same, the substantial differences suggest that tinplate-making was probably less mechanized than other branches of the steel industry.

1937, and other items not enumerated 12·7 %. The share of steel in total material costs was on the increase since 1933.

Considering that wage-rates are adjusted in the trade according to changes in the price of *tinplate bars*, an overwhelming proportion of all costs in the trade is directly determined by prices of tinplate bars. This proportion may amount to two-thirds of all costs or about 55–60 % of the gross value of the product at the factory.

Changes in raw-material costs per unit followed closely changes in raw-material prices, except in the single year 1930. This suggests that the amount of raw materials needed per unit of output remained unchanged throughout the period, no doubt because there was little or no technical progress in the industry. The small change in output per head has already pointed to the same fact.

As for the amount of steel needed per unit of output, the loss of weight in the conversion of tinplate bars into blackplates is the relevant factor. This loss remained throughout the period at the same level, somewhat above 18 %, and, if anything, rather increased. It should be noted, however, that this coefficient of loss is influenced by other factors as well as by technical progress—for instance, by the demand for diversified types of product.

For the amount of tin used per unit of output, data are available only for 1935 and 1937. The amount used per standard box amounts to 1·74–1·77 lb., which is somewhat higher than the amount used in the U.S.A.*

As for the supply and prices of tinplate bars, the situation is complicated by the fact that, in terms of capacity, three-fourths of the tinplate producers were throughout the inter-war period steel producers themselves, and that tinplate production is the main outlet for Welsh steel production. The import of (usually cheaper) tinplate bars, until the imposition of the tariff, has had considerable marginal influence on home prices. The quantity of imported tinplate bars was in no year, not even during the peak years of 1926–8 or in 1931, a high proportion of the total quantity consumed; an overwhelming proportion of the home demand, over 90 %, was supplied by home-produced tinplate bar. For the smaller not integrated tinplate producers, however, its importance was considerable. From 1933 onwards, there was practically no import of tinplate bars, except in 1937, when the tariff was temporarily lifted to relieve the steel shortage due to the rearmament demand. Before the 1939–45 war tinplate bars bore the same tariffs as other semi-finished steel products, and their price has been fixed by the British Iron and Steel Federation with the concurrence of the Import Duties Advisory Committee. The stoppage of imported tinplate bars was followed by the absorption by bigger firms of a few smaller works which 'hitherto flourished on imported semis'.*

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* Both the coefficient of loss of steel in conversion and the amount of tin used per unit refers to tinplate made by the traditional method. Both factors are fundamentally affected by the introduction of the new technique (both continuous mill and electrolytic tinning). They will result in considerable savings in the amount of raw materials used per unit of output.

Tin prices have much less importance for the tinplate industry than tinplate bar prices. The cost of tin amounts to only about one-quarter of material costs and consequently to about 15 % of factory prices. It is, nevertheless, a cost factor of importance.

Over one-third of the total tin consumption of the world is taken up by the tinplate industries of all countries. In Britain about half of all tin consumed is bought by the tinplate industry. Thus, although the tinplate industry is by far the biggest consumer, it has no bargaining power in dealing with the tin suppliers. Both the tin production and the tin smelting of the world are controlled by a few persons 'holding a large number of interlocking directorates', and prices have been very high relatively to the costs of production.†

(iv) *Gross margins*

Gross margins expanded throughout the period under review. From 1907 to 1924 they increased from £0·74 to £1·83 and, after a short fall to £1·57 in 1930, they increased continuously until 1937, when they amounted to £2·84.

There are no data available showing the changes in the constituent elements of gross margins in the 1907–24 period, when, as has been seen, gross margins doubled. Salaried personnel increased in this period only in proportion to output, but salary-rates no doubt increased, just as wage-rates increased, owing to changes in the price level, and thus salaries per unit must have expanded. Horsepower per unit of capacity also increased in this period; thus part of the increase in gross margins may have been due to higher capital charges.

In the 1924–37 period salaries per unit show no changes. They amounted to £0·20 per unit in 1924, and after a slight increase fell back to the same amount of £0·20 in 1937.

A tentative estimate of the changes in capital charges can also be attempted. In 1918, when the capacity of the industry amounted to about 1 million tons, the capital invested in the industry was estimated at £6 millions,* which would correspond to some £6 per ton of output. Another estimate, relating to the end of the period, can be derived from the statement of the Chairman of Richard Thomas, quoted in *The Economist* of 16 September 1939. He stated that 265 old-type sheet and tinplate mills of the Company stood in their books, after heavy writing down, at £1·6 millions; this corresponds to a capital value of £2·5–3 per ton of capacity. This would suggest that capital intensity in the trade has declined in the inter-war period. This is borne out by horse-power data, at least for the 1924–30 period, which show no great changes in horse-power per unit of capacity. Unfortunately, no such data are available

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* D. L. Burn, *The Economic History of Steelmaking 1867–1939*, Cambridge, 1940, p. 451.

† P. Lamartine Yates, *Commodity Control*, London, 1943, p. 141; also Ch. VII, Tin, pp. 130–56; and J. W. F. Rowe, *Markets and Men*, Cambridge, 1936, p. 164; also Ch. VII, Control Schemes of Tin.

Table 51. *Changes in production, prices and costs in the tinplate trade*, 1907–37

	1907	1912	1924	1930	1933	1934	1935	1937
(1) World production	100	130*	178	214	226	219	233	316
(2) British production	100	120	145	135	129	124	121	155
(3) Export (tinned and blackplates)	100	—	126	111	101	89	80	103
(4) Export (tinned plates only)	100	119	137	125	111	95	84	113
(5) Home consumption (tinned and blackplates)	100	—	207	213	214	227	246	311
(6) Home consumption (tinned plates only)	100	140	181	188	194	215	229	312
(7) Selling price of tinplate (wholesale)	100	100	160	116	112	118	126	159
(8) Average selling price of tinned plate, etc. (factory)	100	102	173	137	124	128	134	162
(9) Material costs per unit of output	100	100	159	118	103	109	111	141
(10) Wages costs per unit of output	100	—	211	195	183	172	177	181
(11) Prime costs per unit of output	100	—	169	131	117	121	123	148
(12) Gross margins per unit of output	100	—	247	212	234	259	315	384
(13) Output per head (productivity)	100	98	105	103	105	107	108	118
(14) Output per man-hour	100	—	110	—	—	—	124	—
(15) Wage rates	—	108*	—	—	—	—	—	—
(16) Raw-material prices	100	—	155	—	—	—	—	—
(17) Average hours of work	—	—	—	—	—	—	—	—
(18) Average earnings per man	100	—	200	—	—	—	—	—
(19) Average earnings per man-hour	—	110	—	148	—	—	—	—
(20) Horse-power available per operative	100		117				—	
(21) Horse-power available per unit of output	100	123 —	109	134 —	— —	— —	—	— —

Source. Based on tables in this chapter, and *Statistical Yearbook*, 1939, International Tin Research and Development Council.

Notes. Rows (8)–(13) refer to all products of the tinplate trade, such as tinned and terneplates and sheets, and blackplates for sale.

* For 1913.

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* See *Report of the Departmental Committee on the Iron and Steel Trades*, Cmd. 9071, 1918, p. 10.

for the 1930–7 period. If we accept these two estimates of capital invested at the beginning and the end of the inter-war period, capital charges on the basis of £6 invested capital per ton, twenty years' depreciation and a 5 % rate of interest may have amounted to about £0·60 per ton in, say, 1924. Considering the lower book value of invested capital and the decreasing tendency of rates of interest, capital charges at the end of the period may have amounted to not more than half the above amount in, say, 1937. Thus the following picture of the break-up of gross margins may be conjectured:

Table 52. *Changes in production, prices and costs in the tinplate trade*, 1924–37

	1924	1930	1933	1934	1935	1937
(1) World production	100	120	127	123	131	178
(2) British production	100	93	89	85	84	107
(3) Export (tinned and blackplates)	100	88	80	71	63	82
(4) Export (tinned plates only)	100	91	81	69	62	82
(5) Home consumption (tinned and black)	100	103	104	110	119	150
(6) Home consumption (tinned plates only)	100	104	107	119	126	172
(7) Selling price of tinplate (wholesale)	100	72	70	74	78	100
(8) Selling price of tinplate (factory)	100	79	72	75	79	—
(9) Average selling price of tinplate products at factory	100	79	72	74	77	93
(10) Material costs per unit of output	100	74	65	69	70	89
(11) Wages costs per unit of output	100	93	87	82	84	86
(12) Prime costs per unit of output	100	78	70	72	73	88
(13) Gross margins per unit of output	100	86	95	105	127	155
(14) Output per head (productivity)	100	98	100	102	102	112
(15) Output per man-hour	100	—	—	—	112	121
(16) Wage rates	100	97	90*	90	93	103
(17) Raw-material prices	100	66	65	71	71	90
(18) Average hours of work	100	—	—	—	91	—
(19) Average earnings per man	100	89	—	—	91	—
(20) Average earnings per man-hour	100	—	—	—	100	—
(21) Horse-power available per operative	100	127	—	—	—	—
(22) Horse-power available per unit of output	100	123	—	—	—	—

Source. Based on tables in this chapter, and *Statistical Yearbook*, 1939, International Tin Research and Development Council.

Notes. Rows (9)–(14) refer to all products of the tinplate trade, such as tinned and terneplates and sheets, and blackplates for sale.

* Extrapolated.

	1924	1937
Gross margins	£1·83	£2·84
Of which: Salaries	0·20	0·20
Capital charges	0·60	0·30

One item, which may have accounted for at least some part of the increased gross margins, is the cost of excess capacity, which according

Table 53. *Cost structure in the tinplate trade (Elements of costs in the value of output)*, 1907–37

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
			Elements of costs in the value of gross output (as % value of gross output)									Elements of costs in the value of net output (as % value of net output)				
			Prime costs						Gross margins							
Year	Coverage of data (proportion of trade covered by wage Census)	Share of group in the net output of all trades	Wages costs	Social insurance costs	Labour costs	Material costs	Indirect taxes	Total prime costs	Salary bill	Other elements of gross margins	Total gross margins	Wages costs	Social insurance costs	Labour costs	Salary bill	Gross margins other than salary
1907	—	0·3	16·2	—	16·2	78·1	—	94·3	—	—	5·7	74·4	—	74·4	25·6	
1912	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1924	(78·8)	0·4	19·9	0·3	20·2	71·7	—	91·9	0·9	7·2	8·1	70·5	1·1	71·6	3·1	25·3
1930	(88·0)	0·3	23·3	0·4	23·7	67·6	—	91·3	1·2	7·5	8·7	72·0	1·3	73·3	3·8	22·7
1933	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1934	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1935	(80·2)	0·3	21·6	0·5	22·1	64·7	—	86·8	1·3	11·9	13·2	61·3	1·4	62·7	3·7	33·6
1937	—	—	18·2	0·3	18·5	68·2	—	86·7	0·9	12·4	13·3	57·3	1·1	58·4	3·0	38·6

Sources. Census of Production statistics; for salaries, Campion-Marley data; social insurance contributions of employers estimated on basis of social insurance statistics.

Table 54. *Cost structure of the tinplate trade*, 1907–37

(*Prices and costs per unit of output: £ per ton of tinplate*)*

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
	Selling price														
Year	Wholesale tinplate coke, yearly average sh. per box†	Factory tinplate £ per ton	Selling price (factory) tinplate,* etc. £ per ton	Wages costs	Social insurance costs	Labour costs	Material costs	Prime costs	Gross margins	Salaries	Gross margins other than salary	Gross margins as percentage of prime costs	Physical output per head of operative (tons)	Share of wages in the value of net output (%)	Export prices of tinplate £ per ton
						(£ per ton or sh. per box)			£ per ton						
1907	14·8	—	13·23	2·16	—	2·16	10·33	12·49	0·74	—	—	5·9	34·6	74·4	—
1912	14·8	—	13·53	—	—	—	10·31	—	—	—	—	—	33·8	—	—
1924	23·7	24·2	22·88	4·56	0·07	4·63	16·42	21·05	1·83	0·20	1·63	8·7	36·4	70·6	24·8
1930	17·1	19·2	18·09	4·22	0·08	4·30	12·22	16·52	1·57	0·22	1·35	9·5	35·5	72·0	19·8
1933	16·6	17·4	16·40	3·96	0·08	4·04	10·63	14·67	1·73	0·23	1·50	11·8	36·3	68·8	17·6
1934	17·5	18·1	17·00	3·72	0·08	3·80	11·28	15·08	1·92	0·23	1·69	12·7	37·0	65·1	18·4
1935	18·6	19·0	17·67	3·82	0·09	3·91	11·43	15·34	2·33	0·23	2·10	15·2	37·2	61·3	19·6
1937	23·6	—	21·37	3·90	0·07	3·97	14·56	18·53	2·84	0·20	2·64	15·3	40·7	57·3	23·3

Source. Census of Production statistics, etc., as in Table 53. Data adjusted to cover tinplates, etc., only. Allowance is thus made for scrap sold.

* Data in columns (4)–(12) refer to the prices and costs of *all* plates sold (black-, tin- and terneplates and sheets).

† 1 box contains 118 sheets, weighs 108 lbs.

to the pooling scheme is spread over the actual output. The increase of horse-power available per unit of output between 1924 and 1930 can be interpreted in this way.

There is no information on increases in selling costs. These may also have been increased, as it is known that the manufacturers have set up centralized propaganda agencies, etc. It appears, however, considering all factors, that net profits have expanded in the period under review.

CHAPTER VI

PRICES, PRODUCTIVITY AND DISTRIBUTION IN THE BRITISH BLAST-FURNACES TRADE

1. STRUCTURE AND ORGANIZATION

(i) *General introduction*

The main point that had to be kept in mind when analysing pig-iron prices was that pig-iron making is only one stage in the production of iron and steel. As the different stages of steel-making are increasingly integrated, and as the production of basic and acid pig-iron increases in importance, the product tends to pass from one part of the plant to the other and not to be sold on the market.

At least half the output of the trade is controlled by the leading big firms, who also largely control their raw-material supplies of iron ore and coal. Many of the small firms, especially the forge and foundry-iron makers, are specialists. Since the introduction of the tariff, in 1933, production and prices of pig-iron have been controlled by the British Iron and Steel Federation in the same way as are steel products. On the whole the pig-iron trade was a declining industry throughout the inter-war period.

(ii) *Blast-furnaces trade defined*

The blast-furnaces trade, according to the definition of the *Census of Production*, comprises firms that are engaged wholly or mainly in the production of pig-iron and ferro-alloys; thus it is the first stage in the making of steel and steel products.*

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* Technically the different stages of iron- and steel-making are clearly distinguishable and are treated as separate industries by the *Census*. In reality most of the existing firms and concerns, as will be shown later, combine two or more stages of iron- and steel-making. The most integrated firms own their own ore mines and coal mines and run integrated plants where coke ovens convert coking coal into coke, blast furnaces smelt the iron, steel furnaces convert pig-iron into steel and produce ingots, and there are also different types of rolling mills attached to the same plant. The cost

The main products of the blast-furnaces trade are the different types of pig-iron: forge pig-iron, used by the 'wrought-iron trade', foundry pig-iron, used by the 'foundries trade', acid (haematite) and basic pig-iron, used by the 'smelting and rolling trade'. The other main products of the trade, though of much smaller importance, are the different ferro-alloys: ferro-manganese, spiegeleisen, ferro-tungsten, ferro-molybdenum and others used mainly by the smelting and rolling trade.[*]

(iii) *Main factors affecting productivity and cost structure*, 1924–37

Costs, productivity and distribution of income in the blast-furnaces trade in the period 1924–37[†] were influenced by a number of factors, partly technical and partly economic (market).

(*a*) The demand for cast and wrought iron had considerably declined and steel had taken their place. At the same time the production of basic steel and consequently of basic pig-iron, which was preponderant in other countries before the 1914–18 war, had become more and more important in Britain. The changes influenced very strongly the internal production structure of the blast-furnaces trade.[‡]

(*b*) The increasing production of basic pig-iron made it possible to use the very abundant phosphoric ores, even though they are of lesser iron content.

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of production and the profits made by such firms and concerns, as given in their published accounts, refer to the aggregate costs and aggregate profits made at all stages of production taken together. *Census of Production* statistics break up these statistics into the technically distinguished sectors. In each case the product of the previous stage is regarded as the raw material of the trade, e.g. coke for the blast-furnaces trade or pig-iron for smelting and rolling or tinplate bars for the tinplate trade, and is valued as though purchased, i.e. at market prices. Nevertheless, it is important to note that the selling value of the interim product, e.g. of pig-iron transferred to a different department of the same firm, is a mere accounting figure rather than a real market price.

[*] The other products and by-products of the blast-furnaces trade are: (i) iron castings in the rough, which have little importance; (ii) blast-furnace gas; this can be used for heating the blast, for driving pumping engines and for making electricity; (iii) ground slag, formed in the earthy mineral in the ore and the limestone and used to a small extent as railway ballast, for tar macadam, for cement-making, etc. Much of the slag is still wasted. In 1935 all these items, excluding gas used in own works, amounted to about 8 % of the total value of output of the blast-furnaces trade; electricity and gas sold amounted to close on 6 %.

[†] For purposes of the 1907 Census, the blast-furnaces trade has not been treated as a separate industry, and thus cost and prices data cannot be computed from the *Census Report*.

[‡] At the turn of the century 43 % of all pig-iron produced was still ordinary pig-iron; in 1924, after the war, about 32 %; in 1937 about 21 %, of which 18·4 % was foundry iron, 2·1 % forge iron and less than 1 % direct casting and other quality. The decrease in the production of haematite pig-iron was similarly constant and marked. At the turn of the century about 43% of all pig-iron produced was haematite iron; in 1924 it was 32 % and in 1937 it was 22 %. The place of both ordinary pig-iron and haematite iron was taken by basic pig-iron. Its proportion was 10 % in 1900, 33·5 % in 1924 and 52·2 % in 1937.

Location of industry, largely based on coal, moved slightly towards ore, based on the cheap and low iron-content Lincolnshire and Northamptonshire ore mines. Imports of foreign ore declined *pari passu*. The proportion of pig-iron produced from ore raised in the United Kingdom remained largely unchanged, at about 50 %.

(*c*) Although all the major technical changes were already known before the 1914–18 war, technical progress continued throughout the period under review, although very slowly. This meant the introduction into British industry of the technically more efficient procedure which was already in use abroad. Thus newly installed furnaces have had bigger capacity; auxiliary equipment (mechanical charging) was improved; there was some little progress in fuel economy and better use was made of by-products.*

(*d*) As to the market conditions, the decisive factor was the spreading of the open-hearth basic process, which made it possible to substitute scrap for pig-iron.† This factor, together with the weakening of the British steel position on the world markets‡ and the consequential decline in steel output, was the main factor affecting the demand for pig-iron.

(*e*) The tariffs imposed in 1932 and the developments which followed—the setting up of the British Iron and Steel Federation, the agreement with the international steel cartel, price control by the Federation—were the next most important factors in determining prices and profits.

(iv) *Organization*

The organization of the blast-furnaces trade is closely linked up with the organization of the steel industry as a whole. In the pre-tariff era, that is, prior to 1933, although a National Federation of Iron and Steel manufacturers had been in existence since 1918, its work was confined to the collection of statistics and the study of problems of common interest, for example, transport costs. Prices and output were regulated by associations of various kinds and by terminable agreements. The Balfour Report in 1928 stated that such associations existed in almost all branches of the iron and steel industries with the noteworthy exceptions of pig-iron and semi-manufactured steel, the markets in which appear to have been in the main unregulated. 'It is said that price conditions in the pig-iron trade are determined so much by market conditions abroad that manufacturers find a policy of regulating prices ineffective in bad times and unnecessary in good times.'§ There may have been changes in the years immediately before the imposition of the tariff, but the adoption of a protectionist policy in the spring of 1932 in any case profoundly changed the organization of the industry from then onward. This change was marked by the setting up of the British Iron and Steel Federation in 1934 to which all the price-fixing associations were affiliated. Moreover, the British steel industry joined the International Steel Cartel.[*]

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* These points are further discussed on p. 121.

† Before the 1914–18 war the consumption of pig-iron in steel manufacture represented approximately 80 % of the weight of the steel ingots and castings produced, while in 1924 the proportion was 57 % and in 1937 it was 48 %.

‡ Before the 1914–18 war pig-iron exports amounted to over 1 million tons; in 1929 they were about 545,000 tons and in 1937 170,000 tons.

§ See Balfour Report, Part IV, p. 34.

The pig-iron trade was only indirectly affected by the British steel industry joining the International Steel Cartel.[†] This Cartel did not concern itself with the marketing control of iron ore or pig-iron, and consequently pig-iron was unaffected by the limitations of exports and imports arising out of the cartel agreement.[‡]

Pig-iron in many respects 'remained a competitive market up to 1939, although many separate international cartel agreements existed....It happened that entrepreneurs and countries strongly connected by cartels in the market of steel exports competed in the market of pig-iron.'[§]

In the home market the policy of the British Iron and Steel Federation deeply affected the fortunes of the pig-iron trade. As soon as the position of the British Iron and Steel Federation was firmly established, in 1935, its influence was felt in three important respects: entry into the industry, price fixing and, in connexion with the latter, collective action in regard to raw-material prices and subsidization of high-cost producers.[‖]

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[*] The British Iron and Steel Corporation was set up to handle collective purchases and the distribution of imports for the whole British industry, among them that of pig-iron.

[†] Pig-iron duties followed somewhat different courses from steel duties. The general *ad valorem* duty of 10 % imposed in March 1932 was increased to 33⅓ % in June 1932 (a month later than that on steel). The duty remained unchanged until March 1937, when it was repealed to 'relieve raw-material shortage'. It was re-imposed at 33⅓ % in May 1938.

[‡] As for iron ores, the large international steel concerns produced their iron ore or 'frequently bought iron ores on long-term contracts from other entrepreneurs according to prices agreed upon on the basis of general conditions on the steel market. Naturally prices and availability of scrap iron and steel greatly influenced the market for iron ores.' See E. Hexner, *The International Steel Cartel*, The University of North Carolina Press, 1943, pp. 9ff.

[§] Hexner, op. cit. pp. 9ff.

[‖] Entry into the industry came very largely under the control of the Federation in 1936. Schemes of expansion were to be examined in detail in regard to anticipated costs, future markets, etc., by a Committee of the Federation and then submitted for further examination to the Import Duties Advisory Committee. This policy, as it operated during the few years prior to the outbreak of the 1939–45 war, aimed at preventing over-capacity. Burn says that 'all the plans which were considered reflected a high valuation of existing plant and reluctance to depart from the traditional channels of trade' (Burn, op. cit. p. 465). Secondly, the Federation fixed prices. There was a uniform 'delivered' price system for the whole national market, and an elaborate quota system allotted according to the products and associations involved. On the whole the Federation tried to follow a policy of stabilizing prices. In the period 1936–7 increased material costs made necessary a deviation from this policy, and the Federation then accepted as the main principle of their price policy, to be followed by its affiliated associations, the relating of variations in prices to ascertained costs and the submitting of the changes proposed for approval to the Import Duties Advisory

(v) *Concentration*

There was a tendency throughout the inter-war period towards the concentration of production among fewer firms. Economic and financial interconnexions with related trades increased, and technical integration was also carried a stage further.*

(*a*) *Economic.* Pig-iron production is but one stage of the manufacture of iron and steel. There are hardly any pure pig-iron producers. Most of the producers are integrated either backwards with coal and coke production or forwards with steel smelting, steel rolling and probably engineering.

For 1927 the Balfour Report indicated that twelve leading steel concerns, not all of them pig-iron producers, possessed about 47 % of the pig-iron capacity of the country and about 60 % of the steel capacity.†

Committee. (For a critical analysis of the principle, see Burn, op cit. p. 494.) In the course of 1936–7 prices of steel and also of basic pig-iron were increased with the approval of the Import Duties Advisory Committee. From then onwards the Federation made efforts towards price stabilization by keeping material costs low by common effort and also by subsidizing high-cost producers. Home ores were largely controlled by the users themselves. Foreign ores proved to be a difficult problem, complicated by freight tariffs, and there was no common action in this field. But the Federation succeeded in 1937 in making an agreement with the chief scrap merchants, in regard to supply and prices of scrap, the main competitor of pig-iron. The prices were much below the price of pig-iron. Later, in 1938, which is beyond the period under review and has, therefore, no direct relevance to the analysis, an agreement was made with the coke producers in regard to coke prices, though on less advantageous terms than in the case of scrap.

The form of subsidizing high-cost producers is again only indirectly relevant to the pig-iron trade, as it concerned steel producers, and it consisted of the central purchase of foreign pig-iron and scrap at the higher foreign prices, the resale however being at the lower home prices to members of the Federation. The scheme was financed by a uniform levy on every ton of ingot produced. This policy did not operate until the second half of 1937.

* Economic concentration, common ownership or financial and administrative control of a substantial part of the output of the trade and its raw-material producing industries, is all-important in regard to price-fixing and market domination. From the point of view of efficiency (or most aspects of efficiency) technological concentration—the physical integration of plants—is the important consideration. Physical integration of a steel plant from coke ovens to rolling mills secures definite advantages: it saves costs of assembly by avoiding transport; it saves costs of reheating, if pig-iron is transferred to steel works in the molten stage; it may allow the production of more uniform coke, as compared with coke made at the pits; it makes possible the fuller exploitation of by-products, notably coke-oven and blast-furnaces gas, etc. Economic integration may have serious disadvantages, by excluding access to the cheapest sources of raw materials. In some cases it might be more advantageous to use scrap or imported pig-iron or to purchase semis for rolling. It is important to see how far such disadvantages are offset in British industry by technological integration. There are, of course, limits set to the advantages of technological integration by the size of market, etc.

† Part IV, p. 33.

For 1937 it can be estimated* that the eleven leading steel concerns—most of them with extensive vertical integration, that is, possessing coal mines, integrated plants (or control) of coke ovens, blast furnaces, steel furnaces and steel mills and a part also having some engineering interests—controlled less than half of all blast furnaces; the figures are 95 out of 200. In terms of the existing capacity, their control probably extended to 58 %.

In 1935 the three biggest business units employed 35 % of all employment.

The Balfour Report indicated that, in 1927, pig-iron manufacturers controlled their own ore supply in this country or abroad to the extent of about 72 % of the total, and their coke supply to the extent of about 55 % of the total.† Data given in the May Report show that the changes in this respect were rather in the direction of lesser integration. In 1937 iron and steel firms or associated companies controlled approximately 50 % of the ore and about 45 % of the coke used in the industry.‡

All evidence indicates an increased economic concentration in the blast-furnaces trade. The number of units considerably decreased in the period 1924–37. The number of returns, which is roughly speaking a measurement of operating firms, though it does record separately every subsidiary, decreased from ninety-two in 1924 to forty-eight in 1935. The number of establishments, which is roughly speaking a measurement of operating plants in the Census year, decreased from sixty-nine in 1930 to forty-eight in 1935. The number of firms who possess blast furnaces, as recorded in the British Iron and Steel Federation statistics, decreased from 100 in 1924 to sixty-nine in 1935 and fifty-five in 1937. By all evidence, therefore, the number of plants was almost halved in the period under review. Other evidence suggests that it was mainly the small inefficient units which disappeared, while big firms rather increased their share of output in the industry.

In 1930 the ten biggest *establishments* (plants) employed 38 % of the labour force and the twenty-five biggest establishments 66 %; by 1935 these percentages had increased to 46 and 82 % respectively.§

(*b*) *Technological.* There are scattered data which give some idea at least of the degree of physical integration:

Iron ore. In regard to iron ore, the basic fact is that the industry was originally based on coal and not on iron. Lately, together with a slight decrease in the use of imported ore from 34 % in 1924 to 28 % in 1935 and 31 % in 1937, cheap home ores with lower iron content were increasingly used, and the location of industry moved slightly to these new ore sources.

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[*] The British Iron and Steel Federation statistics show the owners of blast furnaces in existence in each geographical district. The May Report, on the *Iron and Steel Industry* (Cmd. 5507, 1937), gives data on the average size of existing furnaces according to districts. Lastly, the *Stock Exchange Year Book* gives some, even if very scanty, information on the range of activity of the iron and steel firms. On the basis of this rather indirect information the above picture of the structure of the pig-iron trade can be given for 1937.

[†] Op. cit. Part IV, p. 33.

[‡] Op. cit. p. 49.

[§] The decrease in the number of firms and plants and the higher concentration of output and employment in fewer plants is due to a technical factor: the increase in the size of the furnaces, discussed later.

In 1924, 71 % of all iron ore consumed by the blast-furnaces trade was still carried by railways, and consequently came from some distance to the furnaces; in 1930 65 %, in 1935 only 60 % and in 1937 62 % was thus carried.

Coke. According to *Census of Production Reports*, in 1907, 8 % of all furnace coke was produced at blast furnaces, the rest, 92 %, at collieries. In 1924 28·4 % was produced at blast furnaces and only 71·6 % at collieries.* There was a further increase in the thirties, as in 1939 three-fifths of the coke oven capacity was at blast furnaces.

Pig-iron and steel. In regard to physical integration of blast furnaces and steel works, an increasing integration mainly in the basic pig-iron section can be ascertained, although this is still much below the state of integration in, say, the U.S.

In 1929 about 65 % of all pig-iron was produced in blast furnaces attached to steel works, in 1936 about 70 %. Furthermore, an increased proportion of the production† by blast furnaces attached to steel works was used molten in their own works: 52·4 % in 1929 and 61·9 % in 1936. A further 12 % in 1929 and 11 % in 1936 was used cold in these steel firms' own works, and 36 % in 1929 and 27 % in 1936 was despatched for use elsewhere. The greater part of pig-iron produced by blast furnaces not attached to the steel works is thus despatched (75–80 %).

From total pig-iron production disposed, that is, from the products of all furnaces including those not attached to steel works, 30 % was used molten in 1924, 35·5 % in 1929 and 45 % in 1937. A further 11 % in 1924 and 1929 and 14 % in 1937 was used cold in the works of steel firms or foundries, while the rest, that is, 59 % in 1924, 53 % in 1929 and 41 % in 1937, was despatched.‡

These statistics suggest that the increase in integration, that is, the use of pig-iron in own works, mainly molten, was due to a large extent to change of structure in favour of basic pig-iron production, although even within the basic pig-iron section there was considerable advancement.

(vi) *Organization of labour*

The structural contraction of output and increase of productivity, which are discussed later, resulted in a contracting labour force in the trade. The insured population in the pig-iron trade, the best index of such movements, decreased from 30,100 in 1924 to 17,300 in 1937, indicating that the rest had probably settled down in other occupations. Owing to heavy cyclical fluctuations, the trade has had considerable unemployment all the time in spite of the structural decrease in its labour force. A heavy expansion of the trade would, however, require a considerable increase in output per man or else the recruitment of new labour.

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* It should be remembered that about the same time economic integration of coke supplies was much higher: for 1927 it is estimated that steel firms controlled 55 % of their coke supplies.

† All the data mentioned refer to 'disposal', i.e. production after allowing for changes in stocks.

‡ Taking the different types of pig-iron products, about three-quarters of the basic pig-iron disposed (61 % in 1924 and 77 % in 1937) is used in molten form, another 11 % in 1924 and 7 % in 1937 was used cold and a small proportion (only 28 % in 1924 and 16 % in 1937) was despatched. Of all other products 60–75 % was despatched; in 1937, 72 % of haematite pig-iron, 60 % of foundry pig-iron and 59 % of forge pig-iron. Of the remaining 40–25 % used in own works in 1937, in the case of haematite iron, half was used molten and half cold, while for ordinary pig-iron the total used by firms in their own works was used cold. As for ferro-alloys in 1937, 89 % was despatched and 11 % used cold in own works.

Practically the whole labour force of the blast-furnaces trade consists of adult males. Labour is very highly organized; there exists a very elaborate and comprehensive machinery for collective bargaining on a national scale.

The main unions covering the industry are the National Union of Blast-Furnacemen, Ore Miners, Coke Workers and Kindred Trades and, to a smaller extent, the Iron and Steel Trades Confederation, which latter caters for the main branches of the steel industry.

In many branches of the iron and steel trade, including the blast-furnaces trade, the standard system of wage-fixing for many years had been the selling-price sliding scale. It was introduced after the 1914–18 war and suspended only in March 1940 for the duration of the war, in favour of a cost-of-living scale.*

In the pig-iron trade such agreements were in operation in almost all the important districts throughout the inter-war period.† The standard product whose price changes regulated the sliding scale, was, with one exception, the pig-iron price of the district product; for example, the price of Cleveland No. 3 in Cleveland, Cumberland haematite in Cumberland and North Lancashire, etc. In many cases changes in pig-iron prices also regulated the sliding scales of operatives in the raw-material trades connected with the pig-iron trade, such as ironstone miners, limestone quarrymen and coke and by-product men.‡

Table 55A summarizes the trend of output and employment in the blast-furnaces trade in the 1924-37 period.

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* Under the price sliding scale, the books of certain key firms, or, if need be, of all firms in a given section of the industry, are examined by independent auditors pledged to secrecy, and the net selling price for the previous quarter of some specific product, usually the standard output of the process, is ascertained. Wages are then increased or decreased by a specific amount for a specified rise or fall in the selling price, but these fluctuations only affect wages above a fixed rate, that rate being payable as a minimum wage. The sliding scale works quite automatically, but it remains necessary to negotiate (*a*) the basic wage-rates to which the sliding scale percentage is added, (*b*) the proportion of this percentage to the percentage change in the selling price. This proportion varies under different agreements, many of which have scales so weighted as to give a bigger proportional wage increase to lower than to higher wage levels.

† See *Ministry of Labour Gazette*, 1925, pp. 270 ff. and *passim*.

‡ In South Wales and Monmouthshire the sliding scales of blast-furnacemen operated according to changes in the prices of steel rails and tinplate bars.

Table 55A. *The Blast-Furnaces Trade: Basic data,* 1924–37.

Year	(1) Quantity of pig-iron produced* '000 tons	(2) Value of pig-iron produced £000	(3) Employment in the blast-furnaces trade	(4)	(5) Percentage of insured un-employed
			Operatives	Salaried	
1924	7159·2	32,559	25,325	1645	14·2
1930	6121·0	20,731	18,083	1279	28·5
1933	4019·0	11,033	10,306	1128	39·4
1934	5777·2	16,413	13,716	1157	23·2
1935	6387·6	18,469	14,551	1264	20·9
1937	8225·7	32,192	18,170	1395	8·6

Source. (1)–(4) *Census of Production* statistics, (5) Ministry of Labour data collected in July of each year and published in the *Ministry of Labour Gazette.*

* In 1937 4609·3 '000 tons produced were basic pig-iron, and 1827·6 '000 tons acid (haematite), while 162·3 '000 tons were forge, and 1626·5 '000 tons foundry pig-iron. Blast-furnace capacity (basic and haematite only) was put at 7320 '000 tons by the reconstruction report of the British Iron and Steel Federation, May 1946 (Cmd. 6811). This document, which contains valuable information on the different branches of the steel industry, has been published since this chapter was written.

2. COST STRUCTURE. A SURVEY OF ITS MAIN CHANGES, 1924–37

The cost structure of the blast-furnaces trade is shown in Tables 56 and 57. The first of these two tables shows the elements of costs in the value of gross output and in the value of net output in percentages based on the aggregate costs and receipts of the trade. Table 57 shows for the main product of the trade, pig-iron, the elements of costs, profits and prices per unit of output.

In the period 1924–33 both material costs and wages costs per unit of output were declining. The decline in prices, though continuous, was, however, smaller than the decline in prime costs, and, consequently, gross margins increased. Indeed, the decline in prices was even smaller than the decline in the amount of prime costs and, consequently, much smaller than the proportion of prime costs. From 1933 onwards, material costs were increasing. Wages costs first fell, then rose, but prices increased, however, proportionately to the increase in prime costs and thus gross margins per unit of output again expanded. Proportionately they amounted to the same percentage of prime costs in 1937 as in 1933.

In the first period, 1924–33, material costs declined by 44 %, wages costs by 35 %, prime costs by 43 %. Selling price at the factory declined by only 39 %, and this small difference in price trends resulted in an increase of gross margins per unit of output by 116 %. In the second period, 1933–7, material costs increased by 52 %, wages costs by 14 %; prime costs, selling price at factory and gross margins increased by 47 %.

For the period as a whole, 1924–37, costs of materials declined by 15 %, wages costs by 26 %, prime costs by 16 %, and factory prices by only 10 %, while gross margins expanded by 317 %. In absolute amounts, selling price at factory decreased from £4·80 to £4·31, labour costs decreased from £0·57 to £0·43, and material costs decreased from £4·11 to £3·50, while gross margins expanded from £0·12 to £0·38.*

Considering the composition of gross output, the proportion of material costs is extremely high, being over 80 % of the value of gross output, while labour costs account for about 10–16 % of the value of gross output. The proportion of gross margins is small, below 10 %. Throughout the period under consideration, 1924–37, prime costs were declining as a proportion of gross output, owing to the decline of both material costs and wages costs, and gross margins were expanding. In 1924 prime costs amounted to 97·6 % and gross margins to 2·4 %, in 1937 prime costs amounted to 91·0 % and gross margins to 9 %. This expansion of gross margins, accompanied by the decline of labour costs, resulted in a sharp decline in the share of wages in the value of net output, from 82·1 % in 1924 to 51·6 % in 1937. Salary bills as a proportion of net output also declined in this period from 7 % in 1924 to 4·6 % in 1937; thus the increase in the share of gross margins was due to increase in other elements than salary, e.g. depreciation, or other overhead or net profits. As gross margins amount to a very small proportion of gross output, it should be borne in mind that a small increase in the amount of gross margins might result in a high proportionate increase in the share of gross margins.

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* For the year 1935, on the basis of a sample, we computed the variations in elements of costs per unit of output for pig-iron of different quality. Selling values are highest in haematite pig-iron, and next in foundry pig-iron; they are lowest for basic pig-iron. They amounted to £3·26, £2·88 and £2·78 respectively. Material costs are highest in the haematite group, £2·61, next in basic pig-iron, £2·35, and lowest for forge and foundry pig-iron, £1·96. Wages costs are high per ton of foundry and haematite pig-iron, £0·40 and £0·37 respectively, and low per ton of basic pig-iron, £0·27. Gross margins are highest for foundry pig-iron, which has the lowest prime costs, £0·52 per ton. They are lowest for basic pig-iron, £0·16 per ton, which is much below the average for the whole trade. Gross margins for haematite pig-iron are much higher, £0·28 per ton.

3. CHANGES IN THE MAIN ELEMENTS OF PRICES AND COSTS ANALYSED

(i) *Selling prices (at factory)*

The first conclusion which emerges from the general survey of prices and costs is that selling prices at the factory move with prime costs, whether costs increase or decline. Similarly to other trades, however, in the blast-furnaces trade also this adjustment was made in such a way that gross margins expanded throughout the period. As a result, in the 1924–37 period as a whole prime costs declined by 16 % and prices declined by 10 %, while gross margins trebled. Considering that gross margins amount to a fraction only of selling price, the tendency is more worth noting than the actual changes.

The main cost elements have been determined by the factors set out below.

(ii) *Wages costs*

Labour costs are rather a small element in the total costs of pig-iron. Consequently, the direct effect of an increase in labour productivity on total costs and prices is relatively small.

The very considerable progress in labour productivity throughout 1924–37 tended to decrease wages costs per unit. The effect of changes of wage-rates in the first period 1924–34 was in the same direction; from 1934 to 1937 part of the decrease in wages costs due to higher labour productivity was absorbed in higher wages. From 1924 to 1937 actual wages costs per unit declined from £0·57 per ton to £0·42 per ton, of which £0·22 decrease was the effect of increased labour productivity and a £0·07 per ton increase the effect of increased wage-rates.

(*a*) *Changes in labour productivity.* There was considerable increase in the productivity of labour in the blast-furnaces trade during the period 1924–37. Taking physical output per head in 1924 as 100, the index increased to 122 in 1930 and to 153 in 1935. There was a slight decrease to 152 in 1937. The increase in productivity was greater than in many other sectors of the iron and steel trade. In the steel-smelting and rolling sector in the 1924–35 period productivity increased only 27 % (by 1937 it increased to 36 %), in the foundries sector the increase was 17 %, and in the tinplate sector it was 2 %. Only in the wrought iron and tube sector and in the cutlery trade was the increase greater. In the material-producing industries of the blast-furnaces trade there was also a favourable development of labour productivity. Output per man of iron ores increased by 90 % and of coke by 44 % between 1924 and 1935.

The increase in output per head in the blast-furnaces trade is due to a smaller extent (about one-fifth of the increase) to the change in the structure of production in favour of basic pig-iron and, to a larger extent (about four-fifths), to technical progress in general.*

The general technical progress in productivity has been due to the increase in the size of blast furnaces and probably also to some improvement in auxiliary equipment (mechanical charging).

All the major technical discoveries in blast-furnaces technique were made in the last century. Britain was the pioneer in many fields, but lost the lead to the United States in the eighties of the last century.† There the development was characterized by an increase in the size of the hearth, mechanical charging, and hard driving, all resulting in economy of man-power, of fuel and of furnace lining. In Britain the development was very slow in all respects. The progress during the 1914–18 war was relatively small and smelting remained the weakest spot in the industry. The Balfour Report states in 1928 that efforts had been directed to improve the auxiliary machinery rather than the furnaces themselves. Mechanical charging had been introduced at about one-quarter of the blast furnaces by that year. A number of new furnaces of large capacity had been built, but average output per furnace was still very low.

In the period 1924–37 considerable progress had been made. The number of blast furnaces in existence declined from 475 to 200 and, considering that fifty-eight new furnaces were built, the dismantling of obsolete furnaces was very rapid indeed. There was a trend towards bigger furnaces. In 1923, 20–25 % of the existing capacity was represented by furnaces of 1500 tons and over weekly output; in 1936 the percentage was 47. In 1923, 50–55 % of the capacity was represented by furnaces of less than 1000 tons weekly output; in 1936 21 % only was so represented.* Average output per furnace in blast increased from 39,400 tons per annum in 1924 to 49,000 in 1930, 65,100 in 1935 and 68,500 in 1937. There are no data to indicate whether any progress was made in the installation of auxiliary machinery in the period 1928–37.†

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* For the year 1935 it was possible on the basis of a sample to make an estimate of the variations in productivity according to the quality of the pig-iron produced. Average output of all sampled firms in 1935 amounted to 463 tons of pig-iron per employee. For firms producing exclusively or overwhelmingly foundry and forge pig-iron output per head averaged 332 tons only, for firms producing acid pig-iron output per head averaged 411 tons, and for firms producing basic pig-iron output per head averaged 593 tons. In other words, labour productivity was the highest in firms producing basic pig-iron and the lowest in firms producing forge and foundry pig-iron. This was partly due to the fact that the bulk of modern equipment installed in the industry during the period had gone into the basic sector, although probably a portion only of the output of basic pig-iron was produced by the new machinery. Also the other sectors having a decreasing volume of production may have benefited by the selective use of the best available machinery, which was not the case for basic pig-iron for which demand was increasing. Thus it appears that in general the unit of labour needed to produce a ton of basic pig-iron is lower than the unit of labour needed to produce a ton of acid pig-iron or foundry pig-iron. If we assume that the relative output per head in the three categories as ascertained for 1935 was constant for the whole period, it is possible to isolate the increase in productivity due to change in the production structure. By calculating and comparing the labour needed to produce the 1924 and 1935 output divided into quality categories, we estimated that the increase in productivity amounts to only 40 % instead of 53 %, the remaining 13 % increase being due to change in the structure of production.

† See Burn, op. cit. pp. 46, 183–4, 188–9.

(*b*) *Changes in wage-rates.* Wage-rates in the trade, as already explained, were regulated by sliding-scale arrangements of ascertained selling prices. Thus wage-rates followed on the whole the trend of wholesale prices, though not of factory prices. As the wage-fixing arrangements were such that basic rates remained unchanged, only additions varied according to selling price, and fluctuations in wage-rates were smaller than fluctuations in prices. Wage-rates never fell as low as did prices in the depression; in 1937, at the end of the period under review, wage-rates were 10 % higher than in 1924, which largely corresponds to price increases as from 1924 to 1937. Average earnings showed even fewer fluctuations than wages. From 1933 onwards it shows a very strong increasing tendency and earnings increased more than wage-rates. This may have been due to longer hours of work (there was an increase from 1924 to 1935, but no data are available for 1937) or to changes in the composition of the labour force in regard to skill or to more intensive effort.* So far as wage-rates and average earnings are concerned, blast-furnace workers fared better than workers in other trades in general. From 1924 to 1935 wage-rates in the blast-furnaces trade decreased by 8 % and average earnings increased by 3 %, while in manufacturing industry in general wage-rates declined by 10 % and average earnings decreased by 1 %. The selling-price sliding scale, especially as prices were fixed not quite according to market factors, favoured the workers.

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* This comparison is somewhat biased in favour of the 1936 data, as it compares existing capacity in December 1923 (i.e. including obsolete capacity) with effective capacity in July 1936. (Sources: Balfour Report and May Report.)

† In spite of this substantial development in the inter-war period, British pig-iron making is still far behind American and even German pre-war practice. In the U.S. about the same number of man-hours were worked in 1937, but they produced more than four times as much pig-iron as in Britain. Some part of the American advance is due to the uniformly higher iron content of American iron ore; but this does not account for the whole enormous difference in labour productivity. This relative backwardness of the British blast-furnace industry is usually explained by the structure of the industry; 'the wide range of qualities and specification required, often in small quantities, particularly for foundry and forge use', is the argument used in 1937 in the May Report. But there appears to be general agreement that even in 1937 both the average size of British blast furnaces and blast-furnace technique in general was well below the optimum level. Even after the building of a number of new furnaces in the period 1924–37 there was 'still in 1937 a dearth of modern blast furnaces and too few all told for the steel capacity of the country' (Burn, op. cit. p. 484). In the U.S. a far higher proportion of pig-iron is produced in technically integrated firms. The average output per furnace in 1937 in Britain amounted to 68,500 tons, while in the U.S. it amounted to 177,600 tons. The concentration of furnace capacity is even more impressive. In the U.S. 42 % of the total furnace capacity is represented by furnaces with less than 400 tons daily output; the corresponding British size category (under 2000 tons weekly) represents 64 % of the total capacity. In the U.S. 78 % of the total capacity is represented by furnaces with over 600 tons daily capacity; the corresponding category in the U.K. (3000 tons or more weekly) represents only 8·7 % of the total capacity.

(iii) *Material costs*

Material costs were influenced by a small economy in raw materials (fuel) per unit of output, but more decisively by the trend of the prices of raw materials. On the whole, material costs showed a declining tendency.

Raw-material costs amount to such a high proportion of the costs of pig-iron production that fluctuations in the raw-material prices are more relevant in determining prices than any other factor.

The basic raw materials of the blast-furnaces trade are iron ore and coke, these two accounting for over 80 % of the total material costs: other ores (scrap, cinder, scale, etc.) account for an additional 5 %, and limestone for less than 3 %. The distribution of raw-material costs changed slightly in the last twenty years, as price changes of ore and coke were not parallel; on the whole, however, their share in material costs is very nearly equal.

So far as changes in the prices of raw materials are concerned, fluctuations were most marked in coke prices, next in the prices of imported ore; there were fewer changes in the prices of home ores, and transport costs appear to have been fairly stable. By combining the price changes of the major elements of the raw-material costs of pig-iron, it was possible to compute an index of raw-material prices. This

* The labour force in the trade, as in any other manufacturing trade, is obviously not homogeneous. There are no British data, but American data show the great variations for earnings for different classes. In 1935, for example, average earnings per man-hour varied from 42·2 cents for common labourers to 96·2 cents for highly skilled blowers; among skilled workers highest earnings were shown in the blowing department and supervisory plant workers, then in the stoking and charging operations, and the lowest in the casting department. (See *U.S. Monthly Labor Review*, April 1936, p. 1039.)

index moved fairly parallel with the index of raw-material costs, indicating that the change in material costs per unit was largely a price phenomenon. For 1935 and 1937 costs were lower than indicated by prices, showing that in these years (as compared with 1924) there was some economy in the amount of raw materials consumed by unit of output. By deflating material costs with the material price index, the magnitude of these economies in terms of costs can be indicated. They amounted to £0·05 in 1930, £0·26 in 1935 and £0·28 in 1937 out of a total factory price of £3·59 per ton in 1930, £3·14 in 1935 and £4·31 in 1937.

Direct information is given in the statistics published by the British Iron and Steel Federation on the use of coal and coke per unit of output. They show a steady though slow decline in the use of coke throughout the period. In 1924 the total amount of coke and coal used, expressed in terms of coal, was more than 40 cwt. per ton of pig-iron produced. It declined to 33·6 cwt. in 1935 and rose to about 33·9 cwt. in 1937. As the average iron content of ore used in the period was decreasing rather than increasing, fuel efficiency may have increased even more than is indicated by coal consumption alone.*

(iv) *Gross margins*

Gross margins expanded considerably in the period 1924–37, though they still remain a fairly low percentage of gross value. In 1924 gross margin per unit of output amounted to £0·12, by 1933 it increased to £0·26 and in 1937 it amounted to £0·38.

From the constituent elements salaries can be estimated at £0·05 in

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* Taking the different types of pig-iron, the least saving in coal per unit of output occurred in the production of haematite pig-iron, a mere decrease from 33·84 cwt. of coal equivalent in 1924 to 31·14 in 1937 per ton; the greatest saving was experienced in the production of basic pig-iron, the drop being from 44·11 cwt. in 1924 to 33·81 cwt. in 1937 per ton; the saving was also great in the case of ferro-alloys, from 63·5 cwt. in 1924 to 49·49 cwt. in 1937 per ton; and somewhat less, but still marked, in the foundry and forge group, from 43·46 cwt. in 1924 to 35·81 cwt. in 1937 per ton.

All the above data show fuel consumption in terms of coal equivalence. In terms of coke in 1937 the consumption per ton of basic pig-iron produced was 22·73 cwt., appreciably above the American level, and even above those continental standards where similarly to this country ore of low iron content is used (for example, Belgium and Lorraine).

The problem of the use of by-products is closely related to fuel economy proper. The utilization of surplus gas, for example, both coke-oven and blast-furnace gas, is dependent on the degree of technological integration of plants and the rate of utilization of these integrated plants. The May Report in 1937 still points to the difficulties of finding outlets for surplus gas and points out that a failure to find such outlets may mean a difference of 9*s.* or 10*s.* in the cost of a ton of pig-iron (op. cit. p. 34).

1924 and £0·04 in 1937, a very small amount. The main items are probably depreciation and net profits. Selling costs, if any, cannot be high, as the product is not really sold, but in most cases the bulk of output is transferred into another part of the same plant or into another plant of the same firm.

A very tentative estimate of the order of magnitude of capital charges can be made on the following basis. In 1930, according to the Sankey Committee, £8 millions would be needed to put up twenty new blast furnaces, each producing 400 tons a day. Not allowing for price changes since 1930, this would suggest a capital investment of about £3 per ton of pig-iron produced.[*] The average life of a wholly new plant is estimated[†] to be from twenty to twenty-five years, though some parts have a shorter life, for example, furnace lining, which has to be exchanged every two years, and some parts a longer life. Assuming twenty years of useful life, the depreciation charge per ton would amount to £0·15 a year, interest at the rate of 5 % (a not unreasonable rate in the period under review) adding another £0·15 per year and the total capital

Table 55. *Changes in the cost structure of the blast-furnaces trade*, 1924–37

		1924	1930	1933	1934	1935	1937
(1)	Selling price (factory)	100	75	61	63	65	90
(2)	Material costs (per unit of output)	100	73	56	60	62	85
(3)	Wages costs (per unit of output)	100	75[*]	65	61	61	74
(4)	Prime costs (per unit of output)	100	73[*]	57	60	62	84
(5)	Gross margins (per unit of output)	100	133[*]	216	200	208	317
(6)	Output per head	100	122	139	148	153	152
(7)	Wage rates	100	90	—	89	92	110
(8)	Raw-material prices	100	74	—	—	68	92
(9)	Average earnings[†]	100	99	95	99	103	119
(10)	Average hours of work	100	—	—	—	105	97[‡]
(11)	Horse-power available per operative[§]	100	137	—	—	—	—
(12)	Wholesale price:						
(13)	Basic	100	—	67	75	78	107
(14)	Haematite: East coast	100	77	63	71	73	119
(15)	West coast	100	80	76	76	77	91

Source. Rows (1)–(6) based on Table 57.

[*] On basis of corrected wages bill (see Table 56).

[†] British Iron and Steel Federation statistics. Earnings in the whole steel trade.

[‡] For 1938.

[§] In the blast-furnaces, smelting and rolling trades.

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[*] It is not stated, though it can be assumed, that the costs indicated would cover the setting up of an up-to-date plant with all the auxiliary machinery.

[†] Burn, op. cit. p. 509.

charge on new equipment would thus amount to about £0·30 per ton. Comparing this with actual gross margins after deduction of salaries, it appears that realized gross margins were insufficient, except in 1937, to cover the capital charges of a newly installed plant, and only in 1937 was a small margin left over and above this hypothetical amount.

Table 56. *Cost structure of the blast-furnaces trade*, 1924–37
(*Elements of costs in the value of output*)

(1) Year of Census	(2) Coverage of data (proportion of trade covered by wage *Census*)	(3) Share of trade group in the value of net output of all trades	(4) Elements of cost in the value of gross output	(5)	(6)	(7)	(8)	(9)
			Prime costs					
			Wages costs	Social insurance costs	Labour costs	Material costs	Indirect taxes	Total prime costs
			as a percentage of the value of gross output					
1924	(57·3)	0·3	11·8	0·2	12·0	85·6	—	97·6
1930	(57·2)	0·3	13·4	0·2	13·6	83·4	—	97·0
1930*	—	—	12·0	0·2	12·2	83·4	—	95·6
1935	(57·2)	0·3	11·2	0·2	11·4	80·6	—	92·0
1937	—	—	9·7	0·2	9·9	81·1	—	91·0

	(10) Elements of costs in the value of gross output	(11)	(12)	(13) Elements of costs in the value of net output	(14)	(15)	(16)	(17)
	Gross margins							
	Salary bill	Other components of gross margins	Total gross margins	Wages costs	Social insurance costs	Labour costs	Salary bill	Gross margins other than salary
	as a percentage of the value of gross output			as a percentage of the value of net output				
1924	1·0	1·4	2·4	82·1	1·4	83·5	7·0	9·5
1930	1·2	1·8	3·0	80·8	1·3	82·1	7·3	10·6
1930*	1·2	3·2	4·4	72·4	1·3	73·7	7·3	19·0
1935	1·3	6·7	8·0	57·7	1·2	58·9	6·9	34·2
1937	0·9	8·1	9·0	51·6	0·9	52·5	4·6	41·9

Sources. Census of Production statistics. Salaries estimated on basis of Campion-Marley data. Social insurance contributions of employers estimated on basis of social insurance statistics.

* Wages bill based on wages statistics of the British Iron and Steel Federation, which gives a lower figure than the Census data.

There are, however, a number of important further considerations to be taken into account. In the above calculation, total capital charges are related to gross margins realized on the main product. Some of these capital charges, especially in a modern plant, would be covered from gross margins of by-products. It is also obvious that an entirely new and modern plant would lead to very considerable economies both in labour needed per unit of output and in respect of the cost of fuel.*

Table 57. *Cost structure of the blast-furnaces trade*, 1924–37
(*Prices and costs per unit of output: £ per ton of pig-iron*)

(1) Year of Census	(2) Selling price (factory)	(3) Wages costs	(4) Social insurance costs (employer's part)	(5) Labour costs	(6) Material costs	(7) Prime costs	(8) Gross margins	(9) Salary bill	(10) Gross margins other than salary	(11) Gross margins as percentage of prime costs	(12) Physical output per head of operative (tons)	(13) Share of wages in the value of net output %
1924	4·80	0·57	0·009	0·57	4·11	4·68	0·12	0·05	0·08	2·6	301	82·1
1930	3·59	0·48	0·008	0·48	2·99	3·48	0·11	0·04	0·07	3·2	367	80·8
1930*	—	0·43	—	0·44	—	3·43	0·16	—	0·12	4·7	—	72·5
1933	2·95	0·37	0·007	0·38	2·31	2·69	0·26	0·06	0·20	9·7	418	57·9
1934	3·04	0·35	0·007	0·36	2·45	2·81	0·24	0·04	0·20	8·5	444	59·9
1935	3·14	0·35	0·007	0·36	2·53	2·89	0·25	0·04	0·21	8·7	461	57·7
1937	4·31	0·42	0·007	0·43	3·50	3·93	0·38	0·04	0·34	9·7	458	51·6

Source. Census of Production statistics, etc., as in Table 56. Data adjusted to cover pig-iron only, excluding other products.

* Wages bill corrected (see Table 56).

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* Capital charges on the existing and less up-to-date machinery are, of course, below the above hypothetical capital charges on new machinery. This can be illustrated by the following data: the May Report puts the total capitalization of thirty-seven companies responsible for 86 % of the country's steel output in 1936, after very heavy writing off in the preceding decade, at £126·7 millions, approximately £12·5 per ton of steel ingot output and £11·5 per ton of ingot capacity. On the other hand, Burn estimates that the cost of an integrated new plant, including coke ovens, for rolling bars and small sections would be roughly £18 per ton of product in 1939, while it was about £14 in 1934. Thus the capital value of existing equipment is lower than that of new equipment and capital charges are probably smaller.

CHAPTER VII

PRICES, PRODUCTIVITY AND DISTRIBUTION IN THE BRITISH BUTTER, MARGARINE, SUGAR, BISCUIT AND WALLPAPER TRADES

1. STRUCTURE AND ORGANIZATION OF THESE TRADES

(i) *Butter trade*

The very considerable butter requirements of the United Kingdom—butter ranks as one of the six most important foodstuffs consumed in Britain—come from three sources: the overwhelming proportion (about nine-tenths in 1935) is imported from abroad, a small proportion is produced in Britain in creameries and factories which specialize in its production, many of which are farmers' co-operative concerns, and an equally small proportion is produced on farms.*

The *Censuses of Production* cover only a section of home producers of butter; they include creameries and factories with more than ten employees; but they exclude the smaller creameries; they also exclude the butter production of dairies chiefly engaged in the distribution of milk (who are, however, not important butter producers); lastly, they exclude the producers of farm butter.

The *Censuses of Production* include, however, apart from the creameries with more than ten employees, another important category, butter blenders, whose chief activity consists of 'blending'† purchased (mostly imported) butter. In exceptional cases they make creamery butter as well as use it for blending.‡ This second category, the blenders, is by far the more important in the butter trade as defined by the *Census of Production.* Out of a total value of £8,508,000 (the value of the output of the principal products of the butter trade as defined by the *Census*), £7,254,000 accounted for the output of blended butter and £1,254,000 accounted for butter made in creameries and sold unblended. The total quantity of creamery butter made and sold unblended by the *Census* trade amounted to 237,800 cwt., and their blended butter output (mostly of imported butter) amounted to 1,485,000 cwt. *Thus, the* Census *butter trade accounts for roughly over half of all creamery producers,* and it also includes blenders who blend about one-seventh of Britain's total imported butter.*

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* See Ministry of Agriculture and Fisheries, *Report on the Marketing of Dairy Produce in England and Wales,* Part II, *Butter and Cream,* Economic Series, No. 30, 1932, p. 13.

† Blending of butter aims at securing a homogeneous product of a required standard of quality. In the main imported butter is used by blending factories, and many English-made blends consist solely of imported butter all the year round (*Report on Butter and Cream,* op. cit. p. 43).

‡ In 1935, out of a total output of 1,485,000 tons blended butter, 37,500 tons were made by the blenders themselves.

The butter trade was expanding throughout the inter-war period. From 1924 to 1935 the output of creamery butter increased by 156 % and of blended butter by 138 %. From 1930 to 1935 the expansion was greatest in the output of creameries; it was much smaller in the output of blended butter. The great increase in the number of firms between 1930 and 1935 (from thirty-eight to sixty-six) and in the number of persons employed has been no doubt due very largely to an expansion of the creamery production. This expansion can be explained directly by the setting up of the Milk Marketing Board in 1933. Under this scheme milk sold to manufacturers for making butter, cheese, chocolate, etc., was heavily subsidized, largely at the expense of the consumers of home-produced liquid milk.†

Altogether it is possible to ascertain an expanding tendency in butter consumption. To a certain extent this expansion has been at the expense of margarine consumption, but the aggregate consumption of fats in the form of butter and margarine has also increased (see Table 58).

Table 58. *Consumption of butter and margarine*

	Consumption per head of		
	Butter lb.	Margarine lb.	Butter plus margarine lb.
1905–9 average	15·8	5·0	20·8
1924–7 average	15·4	12·4	27·8
1930	18·7	11·8	30·5
1931	20·9	10·3	31·2
1932	21·6	9·2	30·8
1933	23·5	8·4	31·9
1934	25·2	7·9	33·1
1935	25·2	8·4	33·6
1936	25·0	8·6	33·6
1937	24·8	8·9	33·7
1943	7·6	17·3	24·9

Sources. 1905–27, *Report on Butter and Cream*, etc., op. cit. p. 21; 1930–7, Imperial Economic Committee, *Dairy Produce Supplies*, 1937, p. 15; 1943, *Food Consumption Levels*, 1944, p. 62.

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* For purposes of the *Census of Production* 'The butter, cheese, condensed milk and margarine trades' are one trade; most of the detailed statistics relate to this composite group. The butter trade, the margarine trade, etc., are subdivisions for purposes of the 1935 Census, and certain data, though by no means all data, are available in the 1935 *Census Reports* for these subdivisions for 1935 and also for 1930.

† For example, in the years before the 1939–45 war the wholesale price for liquid milk amounted to 15*d.* per gallon, while milk for manufacturing was sold at about 5*d.* per gallon—in order to make the products made out of this milk competitive with imported butter, cheese, etc. The 'pool price' paid to the farmer by the Milk Marketing Board was the same whatever the buyer had paid and to whatever use the milk was put. About two-thirds of the home-produced milk was sold liquid, the rest for manufacturing (see F. Benham, *Great Britain under Protection*, New York, 1941, pp. 211–12).

(ii) *Margarine trade*

The margarine trade is relatively small, employing not more than 3000–4000 persons. The total output is produced in a small number of establishments (in twelve establishments in 1935), of which an overwhelming proportion is produced in a very few big establishments. The average size of establishments in 1935 was 226 persons.

Margarine was invented in 1869 by a French chemist at a time of scarcity of edible fats in Europe.* Margarine is *par excellence* the butter substitute for people of small means, and is also used for manufacturing purposes. The consumption of margarine increased considerably in this country after the 1914–18 war. From the early thirties onwards, however, it fell off, partly on account of the increased imports and lower prices of butter. Nevertheless, home production of margarine did not decrease to the same extent as home consumption, owing, mainly, to the fact that imports fell off. An increasing proportion of home supply is produced at home; according to the *Census Reports*, 73·4 % in 1924, 82·4 % in 1930 and 99·5 % in 1935.

(iii) *Sugar and glucose trade*

The sugar and glucose trade, as defined by the *Census of Production*, comprises the beet-sugar industry, the sugar-refining industry and the glucose industry.

The structure of the industry in 1935†—the year to which most of the material refers—owes its existence to different Government measures. In 1925, under the British Sugar (Subsidy) Act, 1925, a subsidy was granted, under certain conditions, on sugar and molasses made from home-grown beet.‡ This measure laid the foundations of the British beet-sugar industry, which expanded rapidly. In 1935–6 fourteen firms owning eighteen plants employed 9500 workers during the season, and produced 471,704 tons of sugar (expressed in white-sugar equivalent). The newly founded sugar industry, however, handicapped the existing refining industry, as the subsidies gave an incentive to beet-sugar factories to refine their raw-sugar products. In 1928 the Government decided, therefore, to assist the refineries by establishing differential rates on imported refined sugar,* the import of which from then onwards practically ceased, and sugar-refining at home expanded considerably.

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* See *Report on Butter and Cream*, op. cit. pp. 25–6.

† Or, more exactly, from 1925 onwards up to the present day.

‡ The subsidy was granted for various reasons, among them the intention of helping the farmers, and that also of making Britain less dependent on imported sugar. It was assumed that the industry would need less and less help, as it became established; the subsidy was, therefore, a tapering one. It was granted for a ten years' period, 1925–34, at a rate of 19*s.* 6*d.* in 1924–7, 13*s.* in 1928–30, 6*s.* 6*d.* in 1931–4. In 1935 the Greene Committee reviewed the experience of the ten years. On the recommendation of one of the members of the Committee, two opposing, the Government decided to continue the subsidy on a basis limited to 560,000 tons a year, for a transitional period of five years. The subsidy was granted upon a diminishing scale determined by reference to the world price of sugar, the price of beet and certain other factors. The actual subsidy in 1935 amounted to 5*s.* 8*d.* per cwt. The Sugar Industry Reorganization Act of 1935, which contains these regulations, also amalgamated the existing beet-sugar factories into the British Sugar Corporation and limited its profits. It has also set up the permanent Sugar Commission, which, among other duties, determines the rate of subsidy. For details see *Report on the Sugar Beet Industry at Home and Abroad*, Ministry of Agriculture and Fisheries, Economic Series, No. 27, London, 1931 (a very detailed and excellently documented account of the beet-sugar industry), the *Report of the Greene Committee*, Cmd. 4871, 1935, and yearly *Reports of the Sugar Commission*, the first for the year ended 31 March 1937. Many of the statistical aspects are covered by

The main products of the sugar and glucose trades, as registered by the *Census Reports*, are:

Raw sugar (that is, sugar produced by beet-sugar factories, but refined by sugar refineries);

Refined sugar (that is, sugar refined by refineries and beet-sugar factories both from imported and home-produced raw sugar);

Glucose (produced from highly refined maize starch);

Molasses (produced as a by-product by both refineries and beet-sugar factories);

Caramel and beet pulp are by-products of small importance.

Refined sugar is mainly used for direct consumption and also for manufacturing purposes, such as making sugar confectionery, biscuits, etc. Before the 1939–45 war about 40 % of total home consumption was used for manufacturing purposes.† Glucose is used for manufacturing purposes and, to a lesser extent, for medical purposes. Molasses are mainly used as a feeding stuff and for distilling, and to a lesser extent for making yeast and polishes.

Practically the total home requirements of refined sugar are refined in Britain (97·3 % in 1935). Of the raw sugar, about one-quarter comes from home-grown beet and three-quarters is imported. Expressed in refined sugar, over one-quarter of the home consumption is covered by home-produced sugar. A small proportion of the imported sugar is refined in Britain and re-exported (15·4 % of the total refined sugar output in 1935). As regards glucose, 79 % of solid glucose and 85 % of liquid glucose were home produced in 1935 and of molasses 33 % only, which is a decreasing proportion. This latter is due to increased imports owing to the expanding production of industrial alcohol.

As was seen above, there are two main types of producers in the trade: beet-sugar factories and sugar refineries. Most of the beet-sugar factories both produce and refine raw sugar. Some of them, however, only produce raw sugar and allow the refining to be done by the refineries. At the same time, some beet-sugar factories do refine imported sugar in their off season to spread

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the *Reports of the Commissioners of Customs and Excise*. Home-produced sugar bears the same excise as the customs duty on Empire sugar. See also F. Benham, op. cit. pp. 53–5; A. Plummer, *New British Industries in the Twentieth Century*, London, 1937, pp. 269 ff.; and *Trade Regulations and Commercial Policy of the United Kingdom*, N.I.E.S.R. Study III, Cambridge, 1943, Chap. vii.

[*] See *Report on the Sugar-Beet Industry*, op. cit. p. 211.

[†] See G. Findlay Shirras and L. Rostas, *The Burden of British Taxation*, N.I.E.S.R. Study II, Cambridge, 1942, p. 113.

their overhead costs.* In comparing individual beet-sugar factories, these differences have to be borne in mind. There are no such differences between refineries, as they refine raw sugar in all cases whether it is made from home-grown beet or is imported raw sugar. Molasses is essentially a by-product of all plants, but for some plants its importance in total output is quite substantial. Glucose is produced by a great number of firms together with sugar-refining, but in a few cases it is the only or main product.

All the beet-sugar factories are of medium size. Refineries vary. A very few big ones (with over 2000 employees) produce a large part of the output. Their total number decreased throughout the inter-war period.

In all branches of the trade there is close collaboration among producers. This follows from the fact that many of their activities are regulated or owe their existence to state control. Conditions are thus, for obvious reasons, not competitive,† and prices of raw materials (beet-sugar), refining margins, etc., are practically statutorily regulated. Price changes in the world market have an influence on the trade in the sense that they are considered as one of the data in fixing subsidies, etc. In this way the great price decreases experienced on the world markets were, though to a smaller extent, allowed to benefit British consumers.

Labour is not well organized. One of the conditions of subsidy is the payment of fair wages and, consequently, productivity of labour has been increasing throughout the inter-war period. In the refining section, the increase from 1924 to 1935 was 131 %,‡ and in the beet-sugar industry from 1924 to 1930 output per man-hour increased by 155 %.§

(iv) *Biscuit trade*

The making of biscuits is one of the important food trades in Britain. With a total employment of 44,000 persons in 1935 and a net output of £9 millions, it is surpassed in importance only by the bread and cakes, cocoa and sugar confectionery, brewing and malting, and preserved food trades. Throughout the inter-war period under review,* biscuit production was expanding. The volume of production nearly doubled and employment increased by 58 %.

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* 'The large refineries are more efficient at refining than the sugar-beet factories, but to protect the latter an industrial agreement was negotiated giving them the right to refine about a quarter of the total sugar requirements of the country. They have not always used their quota; when the margin on refining has been small, they have sold part of their quotas (at about 1*s.* 4*d.* per cwt.) to the large refineries' (Benham, op. cit. p. 55). The agreement was made in 1937 to be valid from 1 October 1936.

† The beet-sugar factories, prior to the amalgamation, were controlled by four groups: (*a*) the Anglo-Dutch group, (*b*) the Anglo-Scottish or Weir group, (*c*) the Tate and Lyle group, and (*d*) the Lincolnshire group (see Plummer, op. cit. p. 288). The Tate and Lyle group has an important position in the refining industry.

‡ In 1924 an output of 19,785,000 cwt. was refined by an estimated number of 10,600 employees. In 1935, on the basis of a sample, it can be estimated that 38,300,000 cwt. refined sugar was produced by 8876 employees. In 1924 output per head amounted to 1,867 cwt., in 1935 to 4,315 cwt.

§ In the beet-sugar industry, output of sugar per worker per season increased from 329,000 cwt. in 1924 to 841,000 cwt. in 1930 (see *Report on the Sugar Beet Industry*, op. cit. p. 146.

The whole expansion was due to an increase in home consumption of biscuits.† Exports, never an important proportion of production, were declining.

The biscuit trade is heavily concentrated, in the sense that a few big establishments control a high percentage of the total employment. At the same time, these big establishments are controlled by competing firms; the biscuits trade is one of the few trades where there is both price and product competition. All, or practically all, the leading firms‡ spend heavily on advertising, and such trade names as Crawford, Huntley & Palmers, Jacobs, Macfarlane Lang, Peek Frean, McVitie & Price, Romary, Ryvita, Carr, and Cadbury and Rowntree (who make chocolate biscuits), to mention only a few, are household names.

The biscuit trade is also one of the few trades where concentration of firms if anything decreased. Together with an expansion of the biscuit trade, the number of firms increased and a proportionately higher number of the new workers found employment in the small and medium firms than in the big firms. In the same period prices were declining, share of wages slightly increasing and gross margins diminishing.

(v) *Wallpaper trade*

The wallpaper trade is relatively small, employing about 6000 persons. Its fate is closely related to that of the building trade, and its expansion has followed the course of the expansion of other building materials trades. Wallpaper has a number of substitutes, although it is still the material used in decorating walls in almost all working class dwellings and in the more old-fashioned dwellings of all classes.

The wallpaper trade was experiencing a slow expansion throughout the inter-war period. From 1924 to 1935 output increased by 43 %, employment increased by 30 %. The increase in productivity—as measured by increase in output per head—was only 10 %. This figure does not allow for potential quality changes in the wallpaper produced or for a slight decrease in the number of male workers in the industry.[*]

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* For 1907 the value of gross output of biscuits is not shown separately, only together with cakes, pastries, etc. The value of the combined output of these items amounted to £9·4 millions in 1907, while in 1924 biscuits alone amounted to £12·7 millions and the output of cakes by large firms £22·4 millions. The expansion of the biscuit trade as shown by these figures is obvious.

† In 1937–8 the average industrial working class household spent 4*d.* per week per household on biscuits, corresponding to an approximate retail value of £9 millions. Middle class families of the local or central government official type spent in 1938–9 about 10*d.* per week per household on biscuits (see Ministry of Labour family budgets collection in the *Ministry of Labour Gazette*, December 1940, and Massey, 'The Expenditure of 1,360 Middle-Class Households in 1938-39,' *J. Roy. Statist. Soc.* Part III, 1942, pp. 159–85).

‡ With the exception of the Co-operatives.

The orientation of the wallpaper trade is mainly towards the home market. In 1935, 8·5 % of the output was exported (in 1934, 9·4 %) and over 96 % of home demand was supplied by British goods.

The wallpaper trade, as shown in Table 45, is one of the most heavily concentrated trades. There has been a small increase in the number of establishments since 1930, but, owing to changes in the basis of the statistics, it is impossible to say how far this affected the concentration of the trade.[†] It is known to be a concentrated trade, and The Wallpaper Manufacturers Ltd., has an extremely strong position in the trade.[‡] It is not known how far prices or output or entry into the trade are regulated by the leading combine.[§]

2. CHANGES IN PRICES AND COSTS

(i) *Selling prices*

Prices of the products of the trades discussed above generally speaking followed the general trend of wholesale prices, although the extent of price decreases varied: *Butter*[‖] prices at the factory (that is, the net selling value of manfacturers) were halved between 1924 and 1935; they decreased by 53 % from 1930 to 1935; *Margarine* prices decreased by 38 % between 1924 and 1935 (and by 35 % between 1930 and 1935); the price of refined *sugar* was one-third in 1935 of what it was in 1924; *Biscuit*[¶] prices declined by 32 % between 1924 and 1935; and *Wallpaper*[¶] prices declined by 19 %.

These price decreases have been caused by different factors; the determining cost factors fared differently in the different industries. Nevertheless, it is possible to recognize the effect of some common factors.

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[*] The number of male operatives decreased from 76 % in 1924 to 69 % in 1930 and 67 % in 1935.

[†] The size distribution for 1930 relates to returns, not, as in 1935, to establishments. There were, however, seventeen returns in 1930 and thirty-one establishments in 1935; the two measures are, therefore, not comparable. In 1930 the seven biggest firms (on the basis of their returns) employed about 91 % of all workpeople.

[‡] See A. F. Lucas, *Industrial Reconstruction and the Control of Competition*, London, 1937, pp. 16, 60–1, 178, 196, 334.

[§] See P. Fitzgerald, *Industrial Combination in England*, 1927, p. 157.

[‖] It should be noted that 'butter' was not a homogeneous commodity in the 1924–35 period; the relative importance of creamery butter slightly increased from 7 to 14 % of the total quantity produced by all *Census* firms from 1930 to 1935.

[¶] Biscuits and wallpaper can be regarded as homogeneous products only in so far as we assume that the product structure (that is, the proportion of cheap to better quality goods) remained unchanged in the period.

(ii) *Material costs*

In all cases, without exception, material costs per unit declined considerably; they declined proportionately more than prices; considering the importance of material costs as a proportion of prices in all industries concerned, this factor (that is, the decline of material costs) was mainly responsible for the price changes.

Costs of materials per unit declined by 33 % in the *butter* trade, 44 % in the *margarine* trade, in the period 1930–5. In the *biscuits* trade the decline was 17 % (in the 1924–35 period 38 %), and in the *wallpaper* trade 26 % (in the 1924–35 period 31 %).*

This decline in the costs of materials per unit was invariably due to a decline in the prices of the specific raw materials of the trade, such as milk for butter-making, oils for making margarine, flour, sugar, butter and dried fruit for biscuit-making and plain paper for making wallpapers. There were, however, some specific factors also at work. For example, in the case of margarine, the decrease in the costs of materials per unit was greater than the decrease in prices of the specific raw materials. This was caused by the fact that a higher proportion of whale oil was used in margarine-making in 1935 than in 1930, and a smaller proportion of vegetable oil, and that whale oil is cheaper than vegetable oil. In another case, that of biscuits, the prices of the specific raw materials of the trade (that is, of the ingredients of biscuit-making) declined more than the unit costs of material. This is due to the fact that the main food ingredients make up only about half of raw-material costs; the other half consists of items like packing material, etc., prices of which may have been less affected than food prices. Also the quality of the biscuits may have improved in the sense that more food ingredients or better packing were used per unit.

While price changes of specific raw materials have been the main factor affecting raw-material costs, economies in the use of raw materials or quality changes in the final product may also have occurred, though their influence, if any, must have been small.

(iii) *Wages costs*

Wages costs per unit also showed on the whole a declining tendency, although the decline was smaller than that of material costs, and their effect on prices, considering the relatively small proportion of wages in prices, slight.

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* For previous years no data are available in the butter and margarine trade. For the sugar trade the change in material costs is complicated by changes in indirect taxes.

The main factor affecting changes in wages costs per unit was the increase in labour productivity and, to a much lesser extent, changes (mostly decreases) in wages-rates.

The most important changes occurred in the *sugar-refining* trade, where wages costs were halved in spite of a small increase in wage-rates between 1924 and 1935; productivity of labour increased by 131 %. In the *biscuits trade*, wages costs declined by 24 % from 1924 to 1935. About two-thirds of this decrease was due to increased productivity and one-third to decreased wage-rates.* In the *margarine trade* the decrease in wages costs per unit was 36 % between 1930 and 1935, of which half was due to an increase in productivity and half to a decline in wages. In the *wallpaper trade* output per operative declined from 1924 to 1930 and, consequently, wages costs per unit increased, but by 1935 productivity of labour was 10 % above, and wages costs about 6 % below the 1924 level. Wage-rates were declining throughout. In the *butter trade* labour productivity appears to have remained unchanged, and decreased wages costs mainly reflect decreases in wage-rates.

(iv) *Gross margins*

Generally speaking, gross margins did not follow fully the declining tendency of prices. There were decreases in gross margins per unit in most of the cases, but these decreases were small, much smaller than either the decline in prices or the decline in prime costs (that is, in the aggregate of wages and material costs).

In the *butter trade*, gross margins per unit declined by 28 %, while prices and prime costs declined by 33 %. In the *margarine trade*, gross margins declined by 12 %, while prices declined by 38 % and prime costs by 43 %. In the *biscuits trade*, gross margins per unit declined by 28 %, while prices declined by 32 % and prime costs by 34 %. In *sugar-refining*, gross margins per unit were more than halved, while prices fell to one-third of the original amount. In the *wallpaper trade*, gross margins declined by 12 %, while prices decreased by 19 % and prime costs by 24 %. These data refer to changes in the 1930–5 period in the first two industries mentioned, and to the 1924–35 period in all other cases. It is clear from these data that, although the fall in gross margins per unit has been in many cases substantial, in no case was this fall proportionately as great as the fall in prime costs. The smaller decrease in gross margins per unit may have been due to the rigidity of some of the overhead cost elements (in two cases where data are available, biscuits and wallpaper, we can observe an increase in the importance of salaries); or it may have been due to rigidity of profits. It is interesting to note that, for example, in the rather competitive biscuits trade, the difference between the decrease in gross margins and in prime costs is much less marked than, say, in the highly concentrated margarine trade.

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* Average wage-rates (as measured by average earnings) decreased only because the proportion of female operatives increased. Thus almost the whole decrease in wages costs per unit is probably due to increased productivity.

Table 59. *Changes in prices and costs per unit of output in the butter and margarine trades*

Year	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Selling price		Prime costs		Material costs		Wages costs		Gross margin	
	£ per cwt.	Index	£ per cwt.	Index	£ per cwt.	Index	£ per cwt.	Index	£ per cwt.	Inde
Butter:										
1930	7·36	100	6·83	100	6·63	100	0·20	100	0·53	100
1935	4·94	67	4·56	67	4·41	67	0·15	75	0·38	72
Margarine:										
1930	2·69	100	1·99	100	1·88	100	0·11	100	0·70	100
1935	1·75	65	1·13	57	1·06	56	0·07	64	0·62	88

	(11)	(12)	(13)	(14)	(15)	(16)	(17)
	Elements of costs in the value of gross output (%)				Share of wages in the value of net output %	Output per head	
	Material costs	Wages costs	Prime costs	Gross margins		cwt. per head	Index
Butter:							
1930	90	3	93	7	30	455	100
1935	89	3	92	8	27	461	101
Margarine:							
1930	70	4	74	26	13	1145	100
1935	61	4	65	35	11	1346	117

(v) *Changes in the share of wages in net output*

The fact that different cost elements decreased to a different extent and especially that gross margins decreased less than other cost elements led to a shift in the proportionate importance of the cost elements in the value of gross output and of net output.

The most important changes occurred in the *margarine trade*, where the share of gross margins in the gross output increased from 26 to 35 %, while the share of wages in the value of net output declined from 13 to 11 %. In the *sugar-refining trade* the share of wages increased, while in the *biscuits* and *wallpaper trades* the share of wages in the value of net

Table 60. *Cost structure of the biscuit trade*, 1924–35
(*Elements of costs in the value of output*)

(1) Year	(2) Coverage of wages data	(3) Share of trade in the value of all trades (net output)	(4) Elements of costs in the value of gross output (%): Wages costs	(5) Social insurance costs	(6) Labour costs	(7) Material costs	(8) Total prime costs
1924	—	0·4	17·7	0·1	17·8	49·6	67·4
1930	65·5	0·5	19·1	0·1	19·2	45·0	64·2
1935	71·8	0·6	19·6	0·2	19·8	45·5	65·3

Year	(9) Elements of costs in the value of gross output (%): Salary bill	(10) Other gross margins	(11) Elements of costs in the value of net output (%): Wages costs	(12) Social insurance costs	(13) Labour costs	(14) Salary bill	(15) Gross margins other than salary
1924	6·9	25·7	35·0	0·5	35·5	13·8	50·7
1930	8·6	27·2	34·7	0·5	35·2	15·6	49·2
1935	9·5	25·2	36·0	0·6	36·6	17·4	46·0

Sources. Census of Production material; for salaries Campion-Marley data; social insurance costs estimated from social insurance statistics.

Table 61. *Cost structure of the biscuit trade*, 1924–35
(*Prices and costs per unit of output*)

(1) Year	(2) Selling prices (wholesale) £	(3) Index	(4) Prime costs per unit of output £	(5) Index	(6) Material costs per unit of output £	(7) Index	(8) Wages costs per unit of output £	(9) Index	(10) Gross margins per unit of output £	(11) Index
1924	5·10	100	3·43	100	2·53	100	0·90	100	1·67	100
1930	4·67	92	2·73	80	1·92	76	0·81	90	1·94	116
1935	3·46	68	2·26	66	1·58	62	0·68	76	1·20	72

Sources. Wholesale prices compiled from *Statistical Abstracts for the United Kingdom* for the years concerned.

output remained largely unchanged or moved slightly upwards. In all cases but one, changes in gross margins in gross output were correlated with changes in the share of wages; the wallpaper trade was the exception. In this trade gross margins in gross output increased, but wages in gross output (owing to the small fall in wages costs per unit) increased more, as a result of which, share of wages moved very slightly upwards.

Table 62. *Changes in prices, productivity and employment in the biscuit trade*, 1924–35

(1) Year	(2) Volume of production	(3) Employment (operatives)	(4) Estimated output per operative*	(5) Share of wages in the value of net output	(6) Gross margins in gross output (excluding salaries)	(7) Output prices (selling prices wholesale)
1924	100	100	100	100·0	100·0	100
1930	130	127	100–102	99·0	106·0	92
1933	153	134	113–114	—	—	76
1934	174	147	118–122	—	—	69
1935	189	155	122–125	103·0	98·0	68

	(8) Average earnings	(9)	(10) Average earnings	(11)	(12) Average hours worked per week	(13)
	Male	Female	All workers	Index	Hours	Index
	s. d.	*s. d.*	*s. d.*			
1924	51/3	29/10	39/10	100	47·8	100
1930	56/1	27/8	35/8	90	—	—
1933	—	—	—	—	—	—
1934	—	—	—	—	—	—
1935	57/0	29/0	36/3	91	48·7	98

* In 1930 41 % of operatives were males, in 1935 30 %. If we allow for this factor, increase in labour productivity would be greater.

Sources. Volume of production index based on the *Census Reports* adjusted for smaller number of firms in 1933 and 1934. Earnings figures compiled from *Ministry of Labour Gazette.*

Table 63. *Changes in output and employment in the sugar and glucose trade*, 1924–35

(1) Year	(2) Refined sugar	(3) Glucose	(4) Molasses	(5) Total output of sugar and glucose trade	(6) Employment
	Output				
1924	100	100	100	100	100
1930	196	107	145	182	133
1935	217	119	125	204	129

Table 64. *Changes in earnings and prices in the sugar trade*, 1924–35

(1) Year	(2) Average earnings per week s.	(3) Average earnings per week Index	(4) Actual hours of work Hours	(5) Actual hours of work Index	(6) Price of refined sugar (with duty) Factory value s.	(7) Price of refined sugar (with duty) Whole-sale s.
1924	62	100	47·2	100	45·50	49·26
1930	64	103	—	—	18·30	24·44
1935	63	102	51·6	109	15·50	21·97

Table 65. *Changes in the cost structure of sugar refineries*, 1924–35

(1) Year	(2) Elements of costs in the value of gross output: Wages costs	(3) Material costs	(4) Indirect taxes	(5) Prime costs	(6) Gross margins	(7) Share of wages in the value of net output
1924	3·5	53·7	38·6	95·5	4·5	43·9
1930	—	—	—	—	—	—
1935	5·2	84·3	4·7	94·2	5·8	47·2

Source. For 1924 the whole sugar and glucose trade. For 1935 based on sample, after excluding beet-sugar factories.

Table 66. *Changes in the cost structure of the wallpaper trade*, 1924–35

(*Elements of costs in the value of output*)

(1) Year	(2) Coverage of wages data	(3) Share of trade in the value of net output of all trades	(4) Elements of costs in the value of gross output: Wages costs	(5) Social insurance costs	(6) Labour costs	(7) Material costs	(8) Total prime costs
1924	(87·6)	0·1	15·0	0·4	15·4	45·0	60·4
1930	(89·1)	0·1	17·6	0·5	18·1	44·4	62·5
1935	(96·9)	0·1	17·5	0·5	18·0	39·1	57·1

	(9) Elements of costs in the value of gross output: Salary bill	(10) Other gross margins	(11) Elements of costs in the value of net output: Wages costs	(12) Social insurance costs	(13) Labour costs	(14) Salary bill	(15) Gross margins other than salary
1924	4·5	35·1	27·2	0·8	28·0	8·2	63·8
1930	4·7	32·8	31·7	0·8	32·5	8·5	59·0
1935	6·1	36·8	28·7	0·9	29·6	9·9	60·5

Table 67. *Changes in prices, productivity and costs per unit of output in the wallpaper trade*, 1924–35

(1) Year	(2) Volume of production	(3) Employment (operatives)	(4) Estimated output per operative	(5) Output prices (at factory) £ per cwt.	(6) Prime costs £ per cwt. of wallpaper
A. 1924	—	—	—	3·49	2·09
1930	—	—	—	3·31	2·04
1933	—	—	—	2·97	—
1934	—	—	—	3·02	—
1935	—	—	—	2·81	1·58
				Output prices	Prime costs
B. 1924	100	100	100	100	100
1930	116	128	91	95	98
1935	143	130	110	81	76

	(7) Material costs	(8) Wages costs	(9) Gross margins	(10) Average earnings per week *s.*	(11) Actual hours of work per week
	£ per cwt. of wallpaper				
A. 1924	1·57	0·52	1·40	46	48·4
1930	1·46	0·58	1·27	43	—
1933	1·17	—	—	—	—
1934	1·11	—	—	—	—
1935	1·09	0·49	1·23	44	50·1
	Material costs	Wages costs	Gross margins	Average earnings	
B. 1924	100	100	100	100	100
1930	93	115	91	93	—
1935	69	94	88	96	103

Sources used were the same as in other trades, i.e. *Census of Production*, *Ministry of Labour Gazette*, etc.

APPENDIX 1

DESCRIPTION OF THE METHODS OF INVESTIGATION

1. METHODS OF CONSTRUCTING THE TABLES AND CHARTS

The statistical results of the cross-section analysis are given in three sets of tables and five sets of charts printed on pp. 49–73 and in the Appendix on pp. 159–99.

(*a*) *Description of tables and charts*

Group A tables (pp. 49–61) show, first, the variations of the share of wages in the value of net output as between and within different size groups. They show, secondly, the variations of the elements of costs in the value of gross output as between different size groups. These calculations were made for all the twenty trades enumerated on p. 20.

Group B tables (pp. 63–9) show the variations as between different size groups in the elements of costs per unit of physical output and in physical output per head. These calculations were made for eight trades only, i.e. those producing homogeneous products.

In Group C tables (pp. 71–3) units are grouped according to the share of wages in the value of net output and not according to size. The tables then show the variation as between these groups in the elements of costs per unit of physical output for each of six homogeneous trades.

An analysis of the dispersion of selling price into parts associated with each of the constituent costs and the correlation of the selling price with the different elements of costs is given in Appendix 3.

Group I charts (pp. 159–66) show the variations as between different size groups in the average value of net output of the wages bill and of material costs per person employed. These charts are based on the same original material as Group A tables, i.e. on the data of firms covered by our sample.* Twenty trades are covered.

Group II (*a*) charts (pp. 167–75) show the variations as between different size groups of the structure of costs in the value of gross output.

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* Variations as between different size groups in the average value of net output and of material costs (though not of the wages bill) per person employed are given (or can be computed) for all firms from the published *Census Reports*. The data for our sample and for all firms covered by the Census are by no means identical, but the trend of variations as between the different size groups does not differ substantially.

Group II (*b*) charts (pp. 167–75) show the variations as between different size groups of the structure of the value of net output. These two groups of charts are a graphical presentation of Group A tables, so far as variations between size groups are concerned.

Group III charts (pp. 177–83) are a graphical presentation of Group B tables.

Group IV charts (pp. 185–88) are an approximation to the Marshallian 'particular expenses curve', i.e. they show how much of the output was produced at each level of prime costs. For this purpose the units, or (in the looser sense of the word) firms, were arranged in ascending order of average prime cost per unit of physical output, and a cumulative figure built up showing the output produced by those with an average prime cost below each level. These cumulative figures were then graphed.

For the purpose of these calculations, the prime cost per unit of physical output was first adjusted to take account of variations in the selling prices of different firms. The reason for this is that these variations probably reflect slight variations in the nature of the product, or in the amount of transport provided by the seller, rather than true price differences. It was therefore thought appropriate to adjust the costs actually recorded for each firm in accordance with the ratio of the average selling price for the whole sample to the firm's price. The adjustments were in fact small, since these charts were drawn only for the four trades with the most homogeneous products, cement, pig-iron, tinplate and margarine.

Group V charts (pp. 189–99) illustrate the variations as between different firms per unit of physical output of selling price, gross margins, prime costs, material costs and wages costs. They are arranged in descending order of selling price. Eight trades, producing fairly homogeneous products, are covered.

(*b*) *Methods of constructing the tables*

For the purpose of *Group A tables*, the necessary statistics, with the exception of indirect taxes, were available in the form required. The ratios, referring to the groups of firms, are weighted averages, as the value of gross output, of net output, of wages, etc. of the individual firms in the group were added up and the ratios of these sums computed.

In calculating the share of the gross margin for individual firms, we found this to be a negative value in a number of cases, i.e. the wages costs were higher than the value of net output, showing that the firm was working at a loss.* This was most frequent in the cotton-spinning trade, but there were sporadic cases also in other trades. By using size groups, these losses are in all trades offset by the positive gross margins of other firms in the same size group.

Indirect taxes were included in the data of brewery firms, both in the value of gross output and in the value of net output. A global estimate only was available for all the firms making wage returns (and thus by our sample). It was not possible, therefore, to calculate exactly the share of wages for groups of firms. We have made an estimate of indirect taxes by assuming that the ratio of indirect taxes to total net output was applicable to all size groups; and we deducted the estimated amount of duties from the value of net output.†

For spirit-distilling no indirect taxes were included either in the gross output or in the net output, as duties are payable only after the distilled spirit is removed from bonded warehouses.

In the case of the tobacco trades, indirect taxes were included in the value of the gross output and of the costs of materials, but they were not included in the value of net output.

In the case of sugar, indirect taxes were included in the value of gross output and of the costs of materials, but not in the value of net output. Subsidies were included both in gross output and in net output, as it was possible in this group to ascertain the value of subsidies and indirect taxes for individual firms. Subsidies are involved only in the case of sugar-beet factories using home-grown beet.

For the calculation of *Group B tables* showing the 'elements of costs per unit of output in different size groups', apart from the data on the value of gross output, net output, costs of materials, wages and average number of persons employed (which were enumerated under Group A above), use has been made of the following further information: quantity of the product manufactured, value of the above quantity.

Group B tables were confined to the eight trades producing more or less homogeneous products. As is described below, in every group the quantity only of the main product, say cement or pig-iron, was taken into account, with an adjustment for other products within the same group, such as gypsum in the cement group, or ferro-manganese in the blast-furnaces group. Those firms were left out whose principal production was not the homogeneous product, and only those firms were taken into account where the value of the main product (or products) produced was nearly the whole, or at least a very high percentage, of the gross output of the firm. In very few cases was the value of the main products manufactured equal to the gross output of the firm, as practically all firms produce some by-products. For example, almost all the pig-iron firms produce ferro-alloys. In these cases, data on gross output, net output, material costs, wages costs and average number of persons employed, which were available only for the firm's whole activities, were adjusted by the usual method of percentage reduction. For example, if a firm in the blast-furnaces trade produced pig-iron which was, say, 95 % of the value of gross output of this firm, gross output, wages costs, etc., were all reduced by 5 % and regarded as representing the costs of the firm in relation to its pig-iron production. This method is, of course, equivalent to the assumption that costs of the two different products (the main product and the by-product) are proportional to their selling value. This assumption may not be correct, but the error introduced in this way is very small, so long as the main product makes up the overwhelming proportion of the total output of the firm.

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* It can be accounted for also by methods of valuations of stocks, especially if there are significant changes in prices of materials and products in the census years.

† This method might be applied because exports—which are free of duty—form only a very small proportion of total output, less than 1 %. At the same time it can be assumed that there is a correlation between the alcohol content of the beer produced and the value of net output.

An alternative method would be to ascertain the volume of home sales for each size group and calculate the duty paid on it. For this purpose, however, the fixed ratio between bulk barrels and standard barrels produced in the year has to be applied in each size group. For 1935, for example, the firms returned their output in bulk barrels and not in standard barrels, and they have not indicated the average strength of their brew of beer.

Although in Group B we were dealing with homogeneous products, within each category we found a number of main products, production data for which were separately recorded. For example, in the tinplate trade, we found five closely related products. In this case, to arrive at a global quantity figure, we converted the data into one quantity of tinned plate. We took the biggest product in the group as the basic product, and the others were converted into this basic product on the basis of relative unit prices. These relative unit prices are available in the printed *Census Reports*. As a check in some cases we tried alternative methods; thus the quantities were added up without regard to price differences, e.g. in the blast-furnaces trade, and the results were hardly affected. Simultaneously for different products in each trade, separate tables were constructed on the basis of data of those firms which largely specialized in the production of any one product. The range of firms included in these tables is necessarily smaller, as it excludes firms which produce more than one product.

THE PRODUCTS DISTINGUISHED IN GROUP B TABLES

In the *Blast-furnaces trade*

Only unit costs of *pig-iron* production were compared. The main products taken into account were:

Pig-iron:
  Forge
  Foundry
  Acid (haematite)
  Basic
all converted into basic pig-iron.

In addition, separate tables have been constructed for the following three products: forge and foundry, acid, and basic pig-iron, on the basis of data of those firms which specialize in any of these products. The data have been adjusted by the percentual method described above.

In the *Tinplate trade*

The main products taken into account were:
Black sheets
Blackplates
Tinned plates
Tinned sheets
Terneplates
Ternesheets
all expressed in terms of tinned plates.

In addition, separate tables have been constructed for the following products: tinplate, blackplates, sheet producers, terneplate, on the basis of data of those firms which specialize in any of these products.

In the *Butter, cheese, condensed milk and margarine trade*

The following groups were distinguished:

Butter, the main products being
  Butter made in creameries and sold unblended
  Blended butter
both expressed in terms of blended butter.

In addition, separate tables have been constructed for creamery butter and blended butter.

Margarine. The only product taken into account was margarine. One firm producing refined imported lard was excluded.

In the *Cement trade*

The main product cement was produced for building. Two firms producing mainly gypsum were left out.

In the *Biscuit trade*

The main categories were those shown in the *Census*:

	Proportion of total output (volume) %	Factory price per cwt.
		£
Sweetened biscuits	79	3·40
Chocolate-coated	12	4·53
Other kinds	67	3·18
Unsweetened biscuits	14	4·01
Unclassified	7	3·08
Total (or average)	100	3·46

This classification, however, does not indicate the actual variations in price, which spread from £6·76 to £1·77 per cwt., and in costs as between different firms.* It is also worth noting that practically all firms produce all the varieties indicated in the above classification. It was, therefore, thought advisable to treat 'biscuits' as one product, but to group firms according to average selling price (factory value), on the assumption that biscuits of whatever kind having the same or similar prices might be regarded as a homogeneous product. Within each such price group all kinds of biscuits have been converted into 'sweetened biscuits' as the most important product.

The grouping of biscuit-producing firms according to their average selling price is still arbitrary, as the price categories relate to average selling prices of firms and not to the average selling prices of the product. This involves a further assumption, namely, that the average price of a firm is probably determined by the proportion of cheap or expensive products produced by the firm, and this proportion is usually overwhelming.

Compared with the other products, such as cement, etc., it should be realized that biscuits are a homogeneous product only in a limited sense.

In the *Wallpaper trade*

The main products were:

Raised material

Wallpaper of other descriptions; this latter was taken as the basic product.

A number of firms showing widely divergent costs and producing probably specialized products were left out.

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* There is the further complication that some firms deliver their goods, and their price probably reflects transport charges.

In the *Sugar and glucose trade*

Within this *Census* group the following categories were computed:

Sugar manufactured from home-grown beet. The main products were:

Unrefined sugar
Sugar refined over 98° polarization
- Sugar refined not exceeding 98° polarization expressed in terms of refined sugar over 98° polarization.

In this group unit prices and unit gross margins are shown *excluding* subsidies.

Sugar manufactured from other than home-grown beet. The main products were as given above (except unrefined sugar) expressed again in terms of refined sugar over 98° polarization.

Group C tables were compiled from the same data as Group B tables. The groups show unweighted averages, i.e. every firm of whatever size was given the same weight. Certain small firms showing widely divergent unit costs—and thus probably producing specialized products—were disregarded in the Group C tables, since they would have had a very disturbing effect on an unweighted average.

2. RANGE OF FIRMS COVERED

The range of firms within each trade was confined to the firms which furnished returns of wages in 1935 to the Ministry of Labour. Thus *within each industry we covered, roughly speaking, two-thirds of the firms* and the data can be regarded as representative for the whole subgroup of the trade.*

In the tables in Group B which show the elements of costs per unit of output, etc., usually a smaller range of firms was covered. As in these tables we wanted to compare the unit costs of homogeneous products, we excluded from each subgroup firms who were not engaged mainly in producing the selected product. For example, for Group A tables we included all firms in the cement group which made wage returns; in Group B we excluded firms which produced mainly gypsum.

For purposes of correlations and regressions of output costs and prices, a further restriction was made, and we excluded the few small firms in each group which had widely differing selling prices as it was assumed that these firms were producing some specialized products. From the cement group, for example, three firms were excluded on this account.

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* Our range of firms is, of course, identical with the range of firms included in Table IX ('Wages paid by firms furnishing returns of wages in 1935 and 1930') of the printed *Census Report*, which is given for every single industry. The average share of wages for the industry as shown in our Group A tables should therefore be identical with the share of wages shown in Table IX of the *Census*. Small differences in a few cases are due to the fact that corrections made in the tabulating sheets were taken into account in the *Census Reports*, but were disregarded in our tables, as it was not possible to apportion them among different firms.

In Group A tables we give the number of firms and the weight of the size group, based on total number of persons employed. In Group B tables, the weight of the size group only is given. In Group C tables, which cover largely the same range as Group B tables, we give number of firms and not weights, as the averages are not weighted averages, but unweighted ones, each firm having thus the same weight however big or small a firm it is.

The differences due to the variation in the number of firms do not substantially affect the final results.

3. REPRESENTATIVE CHARACTER OF THE SAMPLE IN REGARD TO INDIVIDUAL TRADES

Blast-furnaces trade

In terms of net output, 57 % of all firms were covered. There are reasons for believing that firms producing forge and foundry pig-iron are not so well represented in the sample as those producing haematite and basic pig-iron. From some of the calculations, a few small firms whose cost structure differed considerably from the general pattern were left out, as it was assumed that they produce some special product; this made the sample even less representative for ordinary pig-iron. For haematite and basic pig-iron producing firms, however, the sample can be regarded as representative.

Data relating to twenty-one firms mostly or exclusively engaged in the production of one type of pig-iron only were separately analysed to ascertain variations in costs structure according to quality and size. This smaller sample covered about 17 % of forge and foundry production, 42 % of basic pig-iron production and 54 % of haematite pig-iron production. As the number of firms involved was very small, size groups were classified as small, medium or large.

Tinplate trade

In terms of net output, 80 % of all firms was covered.

Cement trade

The firms covered accounted for 83 % of the aggregate net output. For purposes of the more refined calculations a number of firms were left out either because they produced some different product—like gypsum—or because their cost ratios were so different that it was safe to assume that their product is a specialized product. Only smaller firms were, however, excluded from the calculations on this latter account, and the sample in all cases covered at least three-quarters of all the firms and of the output of the trade.

Butter trade

From *Census* returns in the 'Butter, Cheese, Condensed Milk and Margarine Trade', data relating to firms producing butter and margarine respectively were separated from the data relating to other firms. Moreover, it was possible to separate within the butter trade data relating to firms employed mainly or exclusively in the production of creamery butter, and those employed in making blended butter. The number of firms in the first class (creamery butter) was six, in the latter (blended butter) fifteen, twenty-one altogether out of the total number of firms in the butter trade, which is given as sixty-six.

The six firms producing creamery butter accounted for about 36 % of the total creamery butter produced by *Census* firms, while the fifteen firms producing blended butter accounted for 42 % of all the blended butter produced by *Census* firms. The sample is, therefore, less representative for creameries than for other butter factories.

Another fifteen firms making wage returns were also considered, but they produced mainly other products than butter and were excluded from the further analysis. These fifteen excluded firms accounted for another 9 % of creamery butter and for another 1 % of blended butter.

Margarine trade

The sample (eight firms out of twelve) covered 90 % of all persons employed and 83 % of the physical output.

Wallpaper trade

The sample covers 95 % of all employment and 97 % of the net output.

Biscuit trade

The sample covers 71 % of all employment and 72 % of the net output.

Sugar and glucose trade

The sample covers thirty firms and about 86 % of the net output.

Out of the thirty firms, fourteen are beet-sugar factories, two factories produced glucose only, which was a by-product of a number of other factories; for six factories molasses was a rather important product, while the remaining eight firms (three very big and five medium) were refineries. Of the total employment covered by the sample, the big refineries accounted for 54 %, the smaller refineries for 13 %, the beet-sugar factories for 27 %, the glucose factories for 2 % and the factories with an important molasses output accounted for over 4 %. It is not apparent how far the structure of the industry as a whole differs from this picture.

Of the output, the sample covered about 80 % of the output of beet-sugar factories (both of their raw and refined sugar), over 90 % of refined sugar output of refineries, about 60 % of glucose output and about 30 % of molasses output.

Unit prices and costs have also been calculated for the different branches of the trade. In the case of the beet-sugar trade, these were expressed in terms of refined sugar.

The range of firms covered for all trades, included in the cross-section analysis, is summarized in Table 68.

Table 68. *Proportion of net output of each trade covered by the sample*

	%		%
1. Blast furnaces	57	10. Shipbuilding	70
2. Tinplate	80	11. Seed-crushing	85
3. Cement	83	12. Starch and polishes	85
4. Biscuit	72	13. Fertilizer, disinfectant, glue	74
5. Margarine*	83	14. Cotton (spinning and doubling)	60
6*a*. Butter, creamery*	36	15. Jute	91
6*b*. Butter, blended*	42	16. Brewing and malting	61
7*a*. Sugar, beet-sugar factories	80	17. Spirit distilling*	71
7*b*. Sugar, sugar refineries	90	18. Tobacco	97
8. Wallpaper	97	19. Soap, candles and perfumery	43
9. Copper and brass	76	20. Gloves	50

* Proportion of physical output covered by the sample.

4. USE OF CAPACITY IN 1935

The year 1935, to which the investigation refers, was the last year when a full *Census of Production* was undertaken.

The general level of industrial activity in this year was moderately good, as can be seen from the following data:*

	Manufacturing production	
	Output	Employment
1929	100	100
1935	109	94
1937	126	105

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* Quoted from *The Economic Journal*, April 1943, p. 49. For production data see the *London and Cambridge Economic Service Annual Index*. For employment data see the index constructed by Mr R. Stone on the basis of insurance statistics allowing for unemployment, *The Economic Journal*, 1939, p. 477.

In regard to the individual trades covered, Table 69 relates to the percentage of insured persons unemployed and will be a significant guide.

Table 69. *Unemployment in the selected trades*, 1935–6

	Percentage of insured persons unemployed		
	January 1935	July 1935	January 1936
Pig-iron	23·6	20·9	18·0
Tinplate	21·6	34·1	34·8
Cement, limekilns and whiting	14·0	9·2	14·9
Bread, biscuits, cakes	12·3	8·9	12·1
Other food trades	16·9	11·6	16·8
Drink industries	11·7	9·4	10·8
Brass, copper, etc.	12·3	10·3	11·4
Shipbuilding	46·1	42·6	36·6
Chemicals	11·0	10·9	10·2
Paint, varnish	7·3	5·5	6·6
Oil, glue, soap	10·2	10·5	9·1
Cotton-spinning	21·4	22·9	17·1
Jute	27·6	57·2	24·6
Wallpaper making	8·3	6·3	8·8
All insured persons	17·6	15·2	16·2

As can be seen, five trades only, shipbuilding, pig-iron, tinplate, cotton-spinning and jute, had more unemployment in 1935 than the average for all industries.

APPENDIX 2

SUMMARY OF FINDINGS WITH REFERENCE TO PARTICULAR CHARACTERISTICS OF EACH TRADE

The very great divergences exhibited by individual trades in their variation of unit costs and productivity are considered here industry by industry.

1. PIG-IRON

The structure of the trade as reflected in the sample was as follows: Employment is fairly evenly distributed amongst the size groups of the firms. Seven large firms (employing 400 persons or more) provide 46 % of all employment. There are five small firms employing less than 100 persons, and providing less than 5 % of employment, which seem to stand out from the rest. This suggests that they are specialist firms producing a product somewhat different from the others or selling under different conditions. Since the firms are small and have low physical output per head they are clearly not more highly capitalized than the rest, and their high margins may, therefore, be attributed to some quasi-monopolistic advantage in their special markets. The groups of the largest firms are not distinguished in any marked way.

Apart from the five smallest firms, there is no clear tendency for prime costs, prices or output per head to vary with the size of firms. The second largest size group, which provides the largest proportion of employment, shows lower output per head and higher prime costs than any but the smallest firms. Prices are, however, below average, owing to a much lower gross margin. The highest productivity is obtained in medium-sized groups. Material costs vary very little with size; this is true also of wages costs.

Dividing those firms which specialize mostly in one or other product into three sections (forge and foundry, basic and acid pig-iron), the position remains largely unchanged in the sense that no clear tendency appears for output per head, prices or prime costs to vary with size in any of the three quality groups. In both acid and basic pig-iron groups, the largest size group has higher prices, higher prime costs and lower output per head than the average. In the basic pig-iron section the medium firms have the lowest prices, lowest prime costs and highest output per head. Neither does gross margin vary with size: medium firms have in both quality groups higher gross margins than large firms.

Prices in the different sections are fairly close together. There are, however, great variations in prime costs and gross margins.

2. TINPLATE

The structure of the trade, as represented by the sample of individual firms, was as follows: No size group employs more than one-fourth of all employees. The highest employment can be observed in the 500–749 employees group, then in the 750 and over group. These two groups, representing the upper strata of firms, employ about 44 % of all employees. Four medium groups employ another 54 %, and four firms with less than 100 employees employ 1·4 %.

The four small firms show rather peculiar features: they have lower share of wages, higher gross margins, lower prices and higher output per head than other firms. They are mainly producers of subsidiary products, and it seemed, therefore, advisable to exclude this small group from further consideration.

There appears to be a very slow decline in prices as the size of the firm grows. Similarly, there is a slight tendency for output per man to increase as the size of the firm grows. There are, however, exceptions to this tendency. Wages costs also tend to decrease as the size of firms grows. As for material costs and gross margins, no definite tendencies appear to be ascertainable. The lowest cost of material per unit is associated with the highest gross margin, but though there is a tendency in this direction it is by no means general.

When we distinguish sections of the trade according to type of product, no further facts emerge. On the whole, it appears that the type of product does not account for any of the tendencies discussed above. Another fact in regard to tinplate worth noting is that wages costs seem to account to a considerable extent for differences in prices, although the differences in prices are greater than the differences in wages costs.

3. CEMENT

The structure of the trade, as reflected in the sample, was as follows: five firms, each employing 200 persons or more, together account for 73 % of all employment in the industry. There are ten medium-sized firms (employing 100–199 persons) providing 17 % of employment. The remaining 10 % of employment is in twelve smaller firms.

Prices tend to fall as the size of the firm grows, though not quite regularly. Material costs fall as the size of firms grows. Material costs per unit of output are much lower in the group of the large firms than in the others. This may be due to the fact that the big firms have their own quarries, while the small firms probably buy from the outside, so that their material costs include someone else's profit. Big firms may also get coal and electricity at a lower price, or their transport costs in conveying raw materials may be lower. Prime costs do not move so regularly with size as material costs because wages costs are relatively low in some of the smaller firms, but the prime costs of the largest firms are much lower than for the rest. Gross margins are markedly higher in the largest size group. Among the rest the tendency of margins to rise with the size of firms is not quite regular.

4. MARGARINE

There is a strong concentration of output and of employment among a few large firms; the average size of firm is relatively big.

The big firms have much higher output per head, lower prices and higher gross margins. They also have lower material costs, nearly equal wage costs with small firms, but lower prime costs. Differences in prime costs are greater than differences in gross margins, thus enabling the big firms to have both lower prices and higher margins.

5. BUTTER

Our sample suggests that, on the whole, small firms are employed in making creamery butter. No firm in this group has more than 200 employees, while the average per firm is forty-one persons. Small and large firms are equally engaged in making blended butter. Out of the fifteen firms in our sample, twelve account for about 21 % of employment, and the remaining three big firms for 79 %.

In the creamery group, the smaller firms have a much lower output per head, higher prices and higher gross margins, but lower material costs. The output per head of the larger firms in the group is three times as high as in the smaller firms, while selling prices and gross margins are lower. The sample is, however, too small to draw any definite conclusions.

Blended butter producers present an entirely different picture. The smallest and the biggest firms have the highest prices, highest costs of materials and the lowest output per head. They also have the highest prime costs, and the biggest firms have the highest gross margins. The two medium groups have much higher output per head, much lower prices and prime costs, and also lower gross margins than the biggest group.

6. BISCUITS

66 % of all employment in the sampled firms is concentrated in big firms, 2·7 % is employed in small firms and 31·3 % is employed in medium firms.

As in the case of wallpaper, an analysis of prices and costs per unit relating to size is made extremely difficult by the great variations in the quality and price of biscuits produced. In the sample studied, average selling prices of firms vary from £6·76 to £1·77 per cwt. We therefore divided the firms into different categories according to selling price.

The highest gross margins per unit of output (as a proportion of prime costs) is realized by the small firms in the highest price category, the next highest by big firms in the lowest price category. The lowest gross margins (as a proportion of prime costs) have been realized by the medium firms.

It is also interesting to observe that the great differences in prices are mainly due to differences in gross margins, and only to a lesser extent to differences in prime costs.

Looking into variations in costs according to size of firms, smaller firms appear to have higher gross margins in every price group but the cheapest; they also have lower prime costs. Big firms have higher gross margins and lower prime costs than medium-sized firms. As for costs of materials, in comparable price groups, big firms appear to have the lowest material costs per unit. There is no regularity in regard to wages costs.

7. SUGAR AND GLUCOSE

Sugar firms mainly engaged in beet-sugar production are all medium-sized firms. Sugar refineries are either medium or big. Four-fifths of the employment is in the big refineries.

Big sugar refineries of imported raw sugar have lower prices. They also have a lower output per head, but substantially lower material costs lead to lower prime costs and higher margins, in spite of lower prices.

8. WALLPAPER

Biggish firms (with 200 employees and over) employ 74 % of all employees.

In analysing unit costs in different-sized firms, difficulties are caused by differences in quality as shown in differences in prices. In our sample small firms exhibit variations in the price of wallpaper per cwt as wide as from £1 to £20, while bigger firms (with more than 100 employees) show a variation in price of only between £2 and £4. Thus unit costs data relating to small firms (representing about 8 % of all employment) are not comparable with data relating to bigger firms.

From data relating to the two bigger size groups it is difficult to draw any conclusions, but it would appear that the bigger size group has a slightly higher output per head, higher prices, higher prime costs and higher gross margins than the smaller size group; but the differences are extremely small.

Comparing costs of different-priced products, it is interesting to note that it is mainly wages costs, and only secondarily material costs, which explain the price differences.

APPENDIX 3

RESULTS OF THE STATISTICAL ANALYSIS OF COST FACTORS

1. *Partitioning of the dispersion of selling price* into parts associated with each of the constituent costs and additional terms associated with the intercorrelation of these costs.

Formula: $\sigma_s^2=\sigma_n^2+\sigma_w^2+\sigma_p^2+2r_{mw}\sigma_m\sigma_w+2r_{mp}\sigma_m\sigma_p+2r_{wp}\sigma_w\sigma_p$, where σ is the standard deviation of

s = selling price per unit of output
m = material costs per unit of output
w = wages costs per unit of output
p = gross margins per unit of output

and r is the correlation coefficient.

Cement: $\sigma_s^2=0{\cdot}034$.

$$\begin{aligned}\sigma_s^2&=0{\cdot}080+0{\cdot}013+0{\cdot}048+0{\cdot}016-0{\cdot}095-0{\cdot}028\\&=0{\cdot}157-0{\cdot}123\\&=0{\cdot}034.\end{aligned}$$

Pig-iron: $\sigma_s^2=0{\cdot}3003$.

$$\begin{aligned}\sigma_s^2&=0{\cdot}3897+0{\cdot}0499+0{\cdot}4091-0{\cdot}0502-0{\cdot}4867-0{\cdot}0115\\&=0{\cdot}3003.\end{aligned}$$

Tinplate: $\sigma_s^2=0{\cdot}35953$.

$$\begin{aligned}\sigma_s^2&=0{\cdot}11588+0{\cdot}13775+0{\cdot}26700+0{\cdot}09852-0{\cdot}06089-0{\cdot}19872\\&=0{\cdot}35953.\end{aligned}$$

Butter: $\sigma_s^2=0{\cdot}03312$.

$$\begin{aligned}\sigma_s^2&=0{\cdot}04336+0{\cdot}00325+0{\cdot}01031-0{\cdot}00727-0{\cdot}01966+0{\cdot}00313\\&=0{\cdot}03312.\end{aligned}$$

Margarine: $\sigma_s^2=0{\cdot}00557$.

$$\begin{aligned}\sigma_s^2&=0{\cdot}00764+0{\cdot}00007+0{\cdot}00526+0{\cdot}00104-0{\cdot}00785-0{\cdot}00060\\&=0{\cdot}00557.\end{aligned}$$

Biscuits: $\sigma_s^2=0{\cdot}18833$.

$$\begin{aligned}\sigma_s^2&=0{\cdot}02316+0{\cdot}01099+0{\cdot}08453+0{\cdot}01341+0{\cdot}02637+0{\cdot}02989\\&=0{\cdot}18833.\end{aligned}$$

Beet-sugar: $\sigma_s^2=0{\cdot}18198$.

$$\begin{aligned}\sigma_s^2&=0{\cdot}03292+0{\cdot}00099+0{\cdot}09866-0{\cdot}00650+0{\cdot}06759-0{\cdot}01168\\&=0{\cdot}18198.\end{aligned}$$

Wallpaper: $\sigma_s^2=0{\cdot}07719$.

$$\begin{aligned}\sigma_s^2&=0{\cdot}01954+0{\cdot}00645+0{\cdot}02908+0{\cdot}01240-0{\cdot}00610+0{\cdot}01583\\&=0{\cdot}07719.\end{aligned}$$

2. *Correlations between the variates:* selling price and costs per unit of utput.

	Selling price	Material costs	Wages costs	Gross margins	Prime costs
Cement:					
Selling price	—	0·78	0·34	−0·34	0·78
Material costs	—	—	0·25	−0·77	0·94
Wages costs	—	—	—	−0·56	0·60
Gross margins	—	—	—	—	−0·85
Prime costs	—	—	—	—	—
Pig-iron:					
Selling price	—	0·36	0·16	0·45	0·41
Material costs	—	—	−0·18	−0·61	0·94
Wages costs	—	—	—	−0·04	0·18
Gross margins	—	—	—	—	−0·62
Prime costs	—	—	—	—	—
Tinplate:					
Selling price	—	0·68	0·37	0·44	0·62
Material costs	—	—	0·39	−0·17	0·82
Wages costs	—	—	—	−0·52	0·85
Gross margins	—	—	—	—	—
Prime costs	—	—	—	—	−0·42
Butter:					
Selling price	–	0·79	0·11	0·11	0·86
Material costs	—	—	−0·31	−0·46	0·96
Wages costs	—	—	—	0·27	−0·03
Gross margins	—	—	—	—	−0·41
Prime costs	—	—	—	—	—
Margarine:					
Selling price	—	0·65	0·46	0·19	0·65
Material costs	—	—	0·69	−0·62	0·998
Wages costs	—	—	—	−0·48	0·73
Gross margins	—	—	—	—	−0·62
Prime costs	—	—	—	—	—
Biscuits:					
Selling price	—	0·65	0·72	0·92	0·80
Material costs	—	—	0·42	0·30	0·90
Wages costs	—	—	—	0·49	0·77
Gross margins	—	—	—	—	0·46
Prime costs	—	—	—	—	—
Beet-sugar:					
Selling price	—	0·82	−0·60	0·94	0·78
Material costs	—	—	−0·57	0·59	0·99
Wages costs	—	—	—	−0·59	−0·43
Gross margins	—	—	—	—	0·54
Prime costs	—	—	—	—	—
Wallpaper:					
Selling price	—	0·58	0·92	0·72	0·79
Material costs	—	—	0·55	−0·13	0·94
Wages costs	—	—	—	0·58	0·80
Gross margins	—	—	—	—	0·15
Prime costs	—	—	—	—	—

APPENDIX 4

RELATION OF ADMINISTRATIVE STAFF TO OPERATIVES IN DIFFERENT-SIZED UNITS

We have attempted to calculate the ratio of salaried staff to operatives in four industries: pig-iron, tinplate, cement and margarine. This is shown in Table 70. If the variations of these ratios is great and shows

Table 70. *Relation of administrative staff to operatives in different-sized units*

Blast furnaces		
Size group	No. of administrative staff per 100 operatives employed	
	A	B
50–99	12·5	13·6
100–199	8·4	8·1
200–299	7·4	7·1
300–399	9·1	8·6
400–499	5·9	5·8
500 and over	6·9	6·8
Total	7·6	7·4

Cement		
Size group	No. of administrative staff per 100 operatives employed	
	A	B
11–49	12·5	12·3
50–99	7·5	7·6
100–199	18·3	17·8
200–749	26·6	26·1
Total	21·2	20·9

Tinplate		
Size group	No. of administrative staff per 100 operatives employed	
	A	B
25–99	10·5	4·3
100–199	3·2	2·6
200–299	3·0	2·6
300–399	4·7	4·6
400–499	3·3	3·0
500–749	3·3	3·3
750 and over	4·1	4·0
Total	3·7	3·5

Margarine		
Size group	No. of administrative staff per 100 operatives employed	
	A	B
100–199	61·1	61·9
200 and over*	11·9	11·3
Total	22·1	21·2

Notes. A, number of administrative staff per 100 operatives employed in mid-week October, 1935. B, number of administrative staff per 100 operatives employed (average for the year).

* The firms included in this size group have authorized the Board of Trade to supply for the purpose of the present inquiry the information which relates to this size group.

a definite tendency to move with size, most of the findings of Chapter III, § 4 are liable to modification.*

As the table shows, for pig-iron and tinplate (especially if we disregard the smallest size group in the pig-iron trade) there is very little variation and no definite tendency. For the cement industry there appears to be a definite trend for salaried staff to increase as the size of unit increases. The explanation for this might be either that bigger and more efficient firms are using considerable extra staff for production planning and similar jobs (i.e. that their type of organization is different), or that their gross margin allows an expansion of overhead costs. In the margarine industry, on the other hand, big firms are using less administrative staff than small firms, although the number of firms in this trade is too small to draw definite conclusions.†

* As the table shows, out of the four industries analysed, in the case of cement only are the findings of Chapter III, § 4 liable to adjustments.

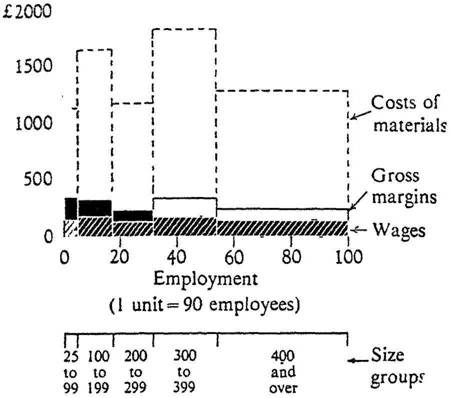
† Differences may be due to the different classification of central office and distribution staffs.

GROUP I CHARTS

Variations in output, gross margins, wages and material cost per person employed between different size groups

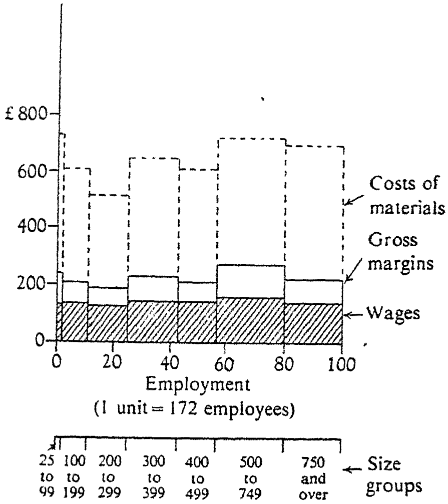
(1) BLAST FURNACES

Output, gross margins and costs of materials per employee



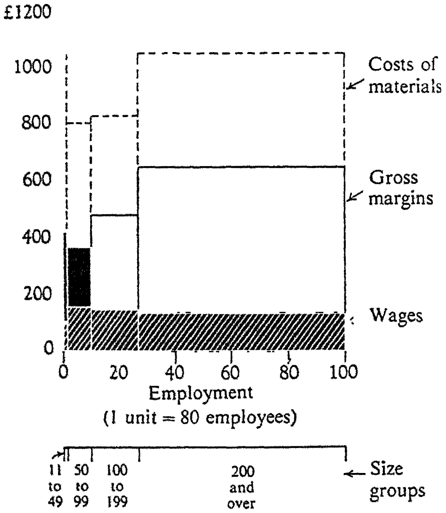
(2) TINPLATE

Output, gross margins and costs of materials per employee



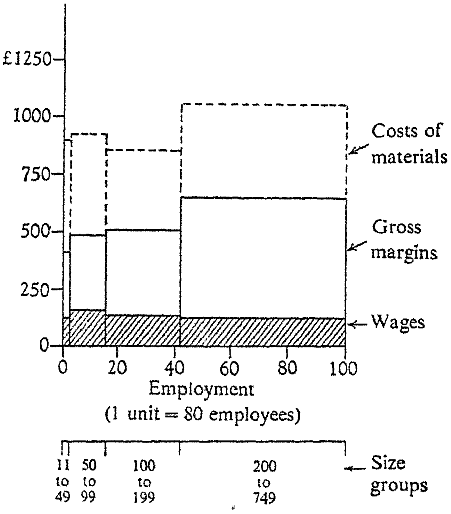
(3*a*) CEMENT (Units)

Output, gross margins and costs of materials per employee



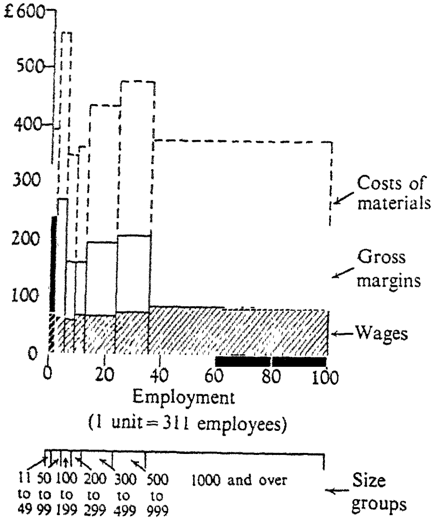
(3*b*) CEMENT (Establishments)

Output, gross margins and costs of materials per employee



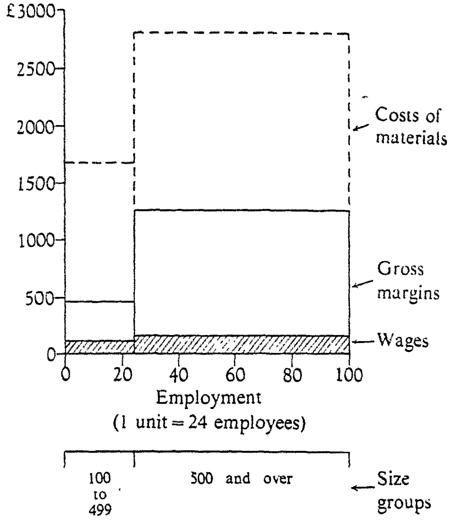
(4) BISCUITS

Output, gross margins and costs of materials per employee



(5) MARGARINE

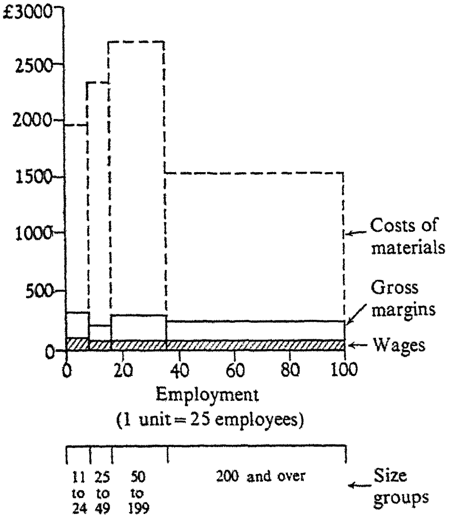
Output, gross margins and costs of materials per employee



* The firms included in this size group have authorized the Board of Trade to supply for the purpose of the present enquiry the information which relates to this size group.

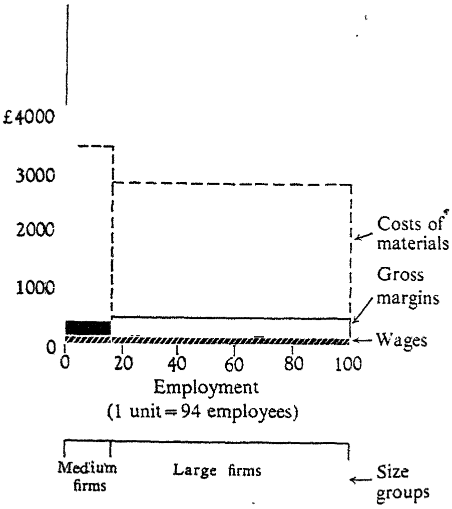
(6) BUTTER

Output, gross margins and costs of materials per employee



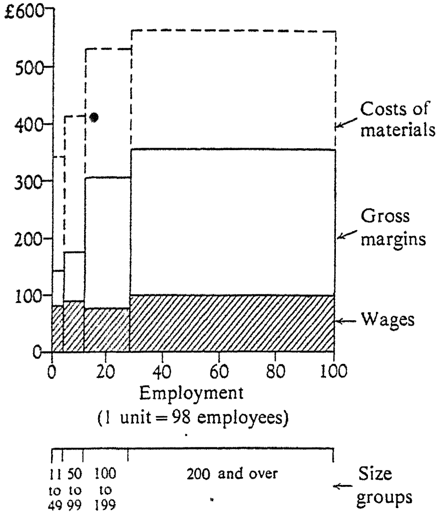
(7) SUGAR REFINERIES

Output, gross margins and costs of materials per employee



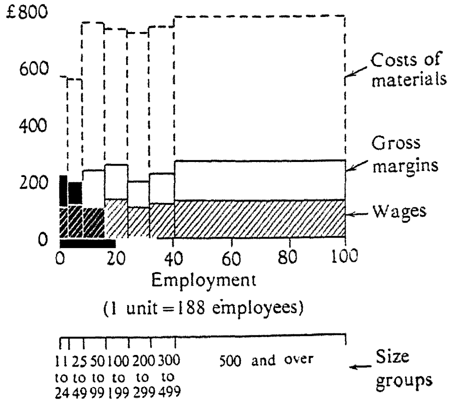
(8) WALLPAPER

Output, gross margins and costs of materials per employee



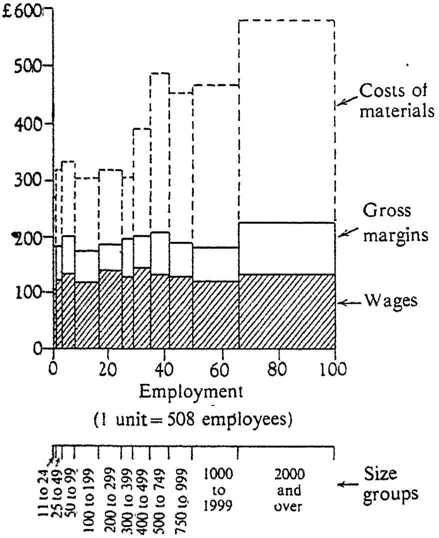
(9) COPPER and BRASS

Output, gross margins and costs of materials per employee



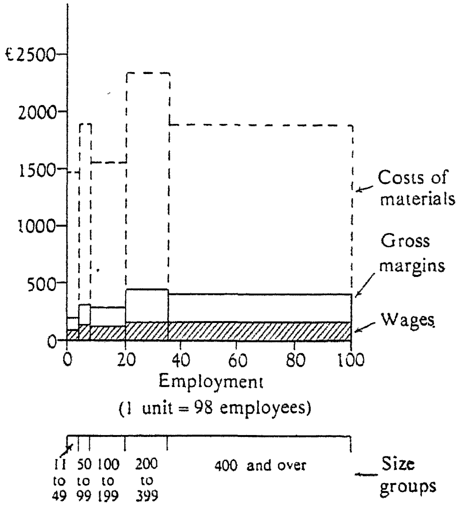
(10) SHIPBUILDING

Output, gross margins and costs of materials per employee



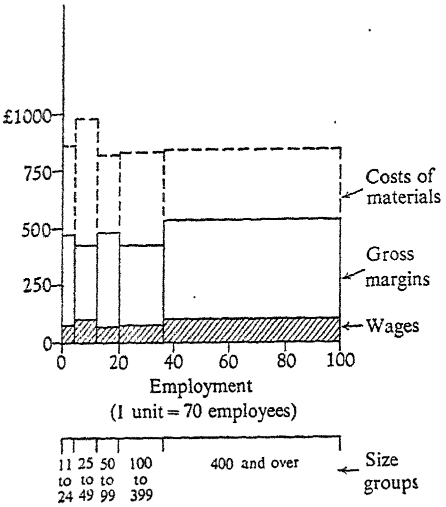
(11) SEED CRUSHING

Output, gross margins and costs of materials per employee



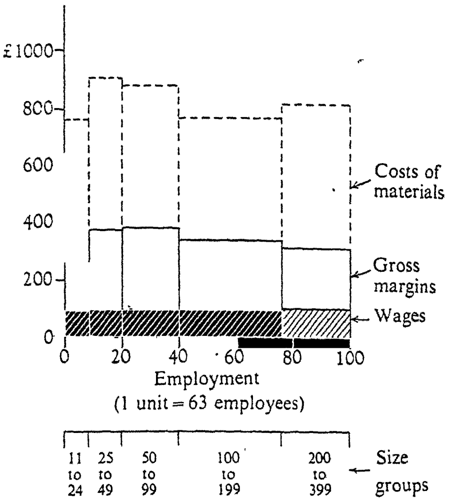
(12) STARCH and POLISHES

Output, gross margins and costs of materials per employee



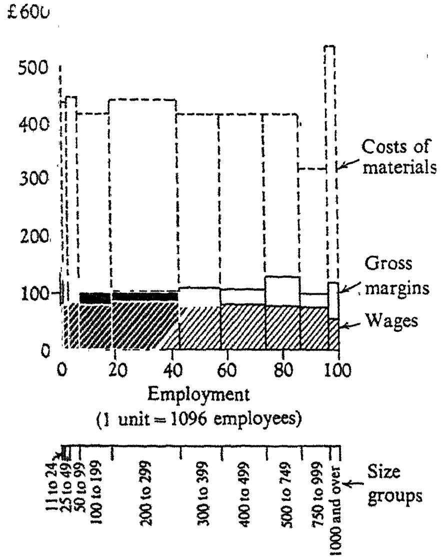
(13) FERTILIZERS

Output, gross margins and costs of materials per employee



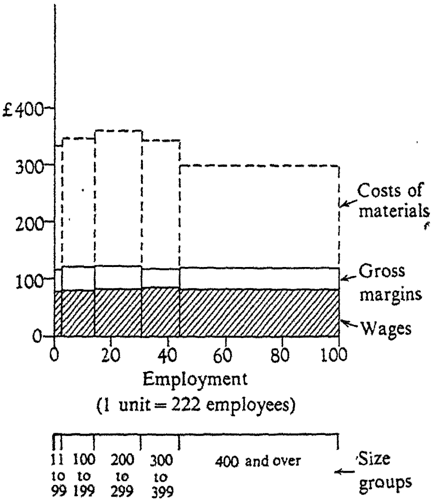
(14) COTTON SPINNING

Output, gross margins and costs of materials per employee



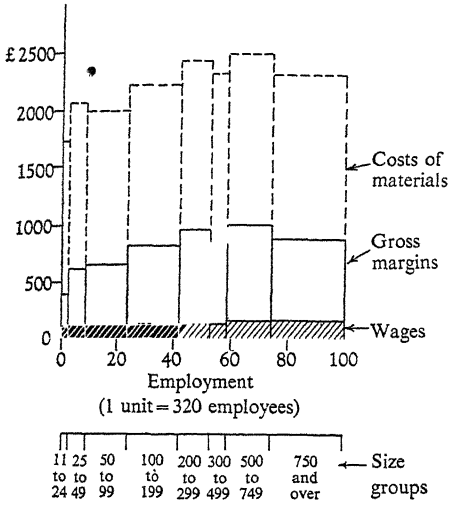
(15) JUTE

Output, gross margins and costs of materials per employee



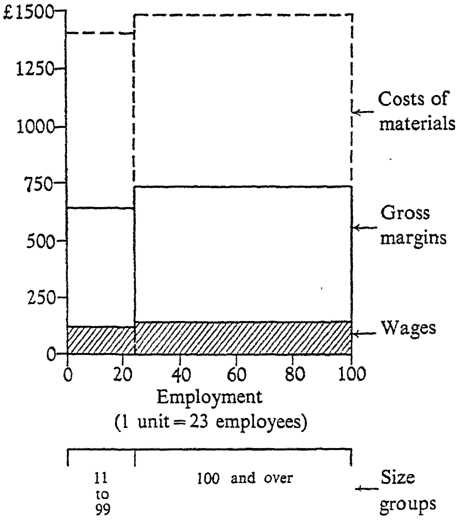
(16) BREWERIES

Output, gross margins and costs of materials per employee



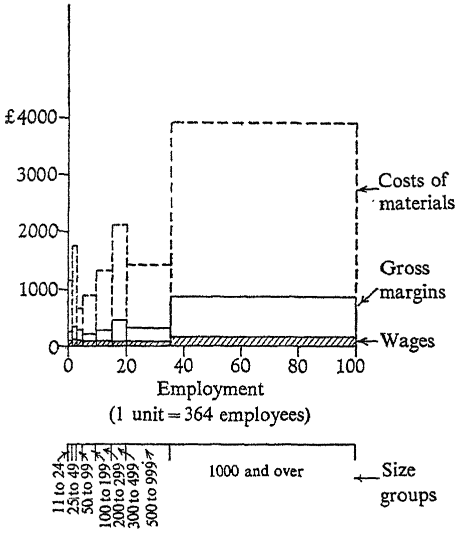
(17) SPIRIT DISTILLING

Output, gross margins and costs of materials per employee



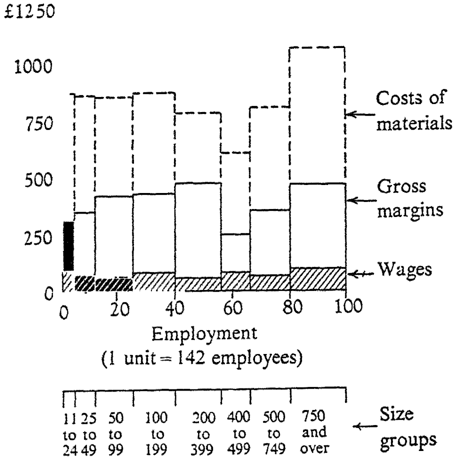
(18) TOBACCO

Output, gross margins and costs of materials per employee



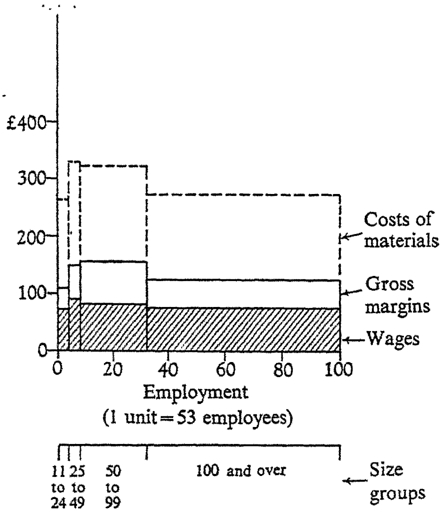
(19) SOAP

Output, gross margins and costs of materials per employee



(20) GLOVES

Output, gross margins and costs of materials per employee

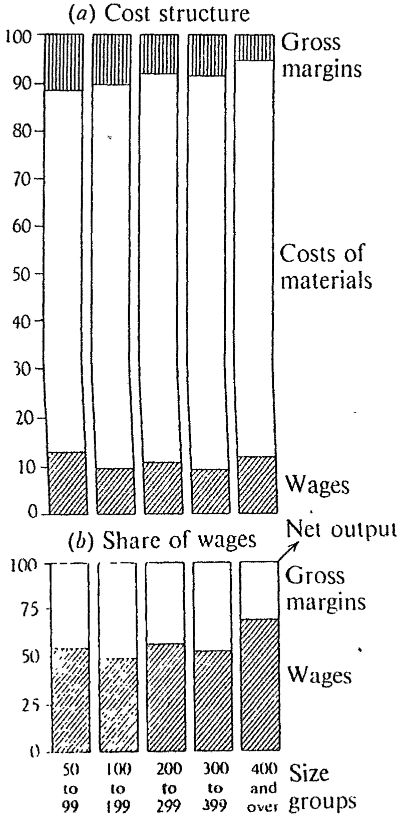


GROUP II CHARTS

(*a*) Variations of the structure of costs in the value of gross output

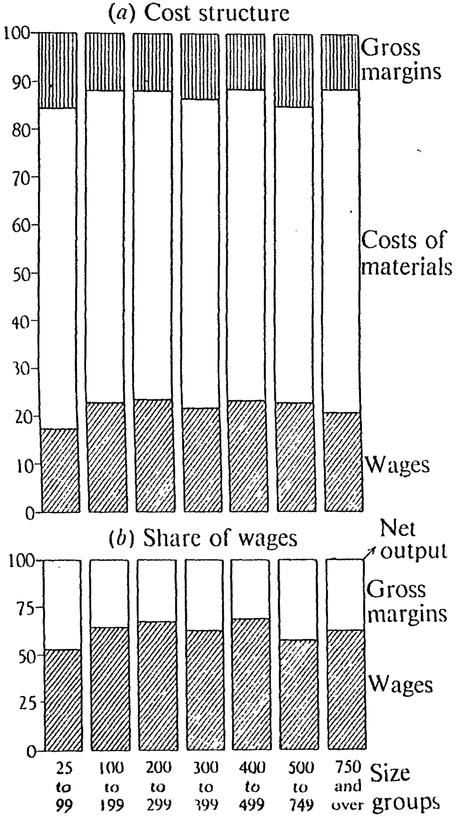
(*b*) Variations of the structure of costs in the value of net output

(21) BLAST FURNACES


(*a*) Cost structure

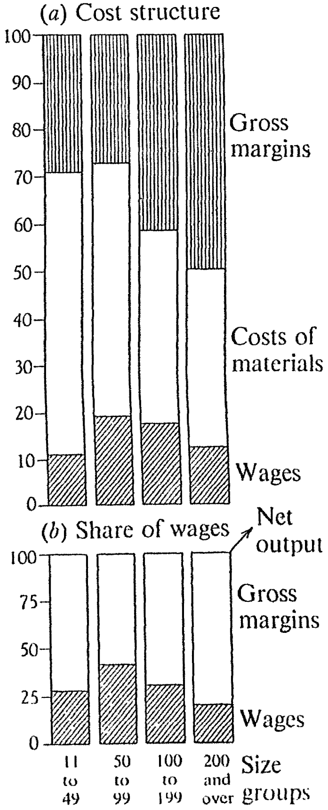
(*b*) Share of wages

(22) TIN PLATE


(*a*) Cost structure

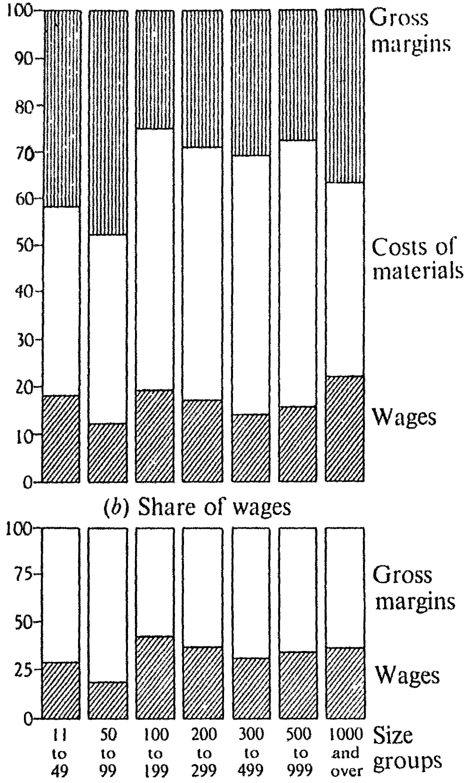
(*b*) Share of wages

(23) CEMENT (Units)

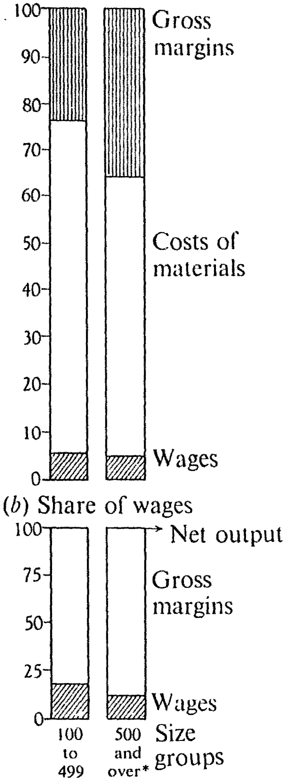

(*a*) Cost structure

(*b*) Share of wages

(24) BISCUITS

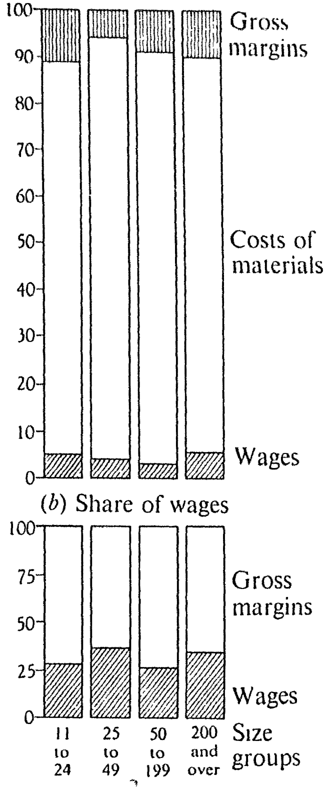


(25) MARGARINE

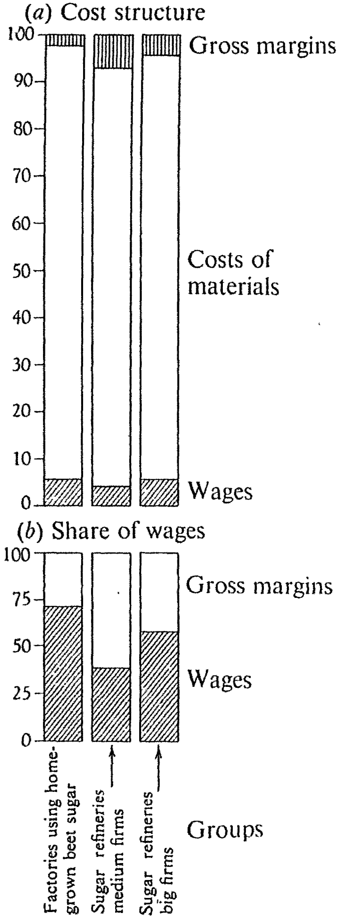


* The firms included in this size group have authorized the Board of Trade to supply for the purpose of the present enquiry the information which relates to this size group

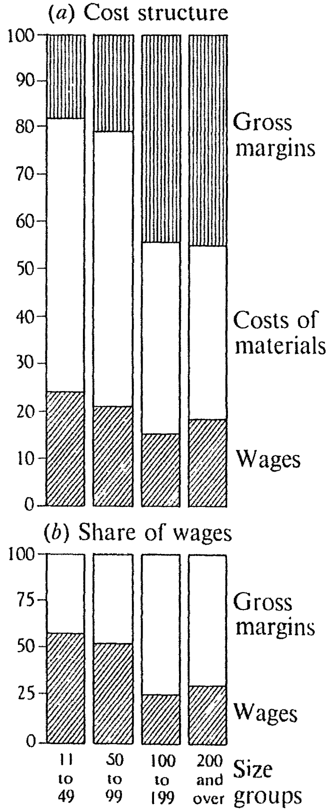
(26) BUTTER



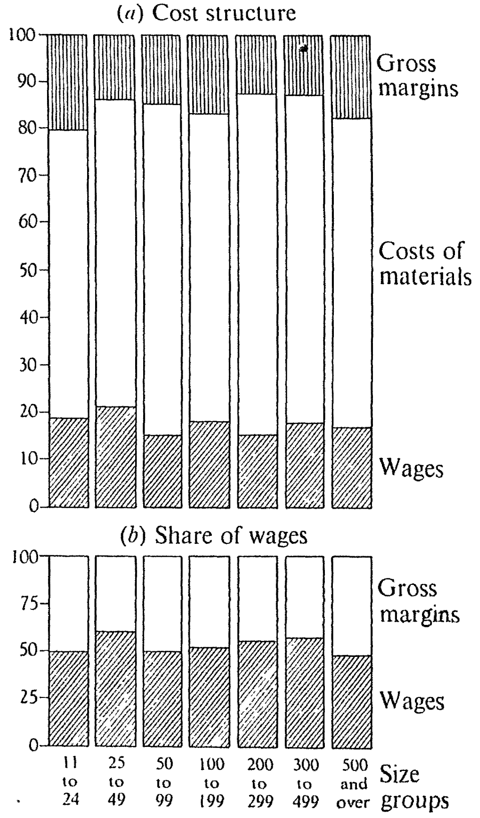
(27) SUGAR



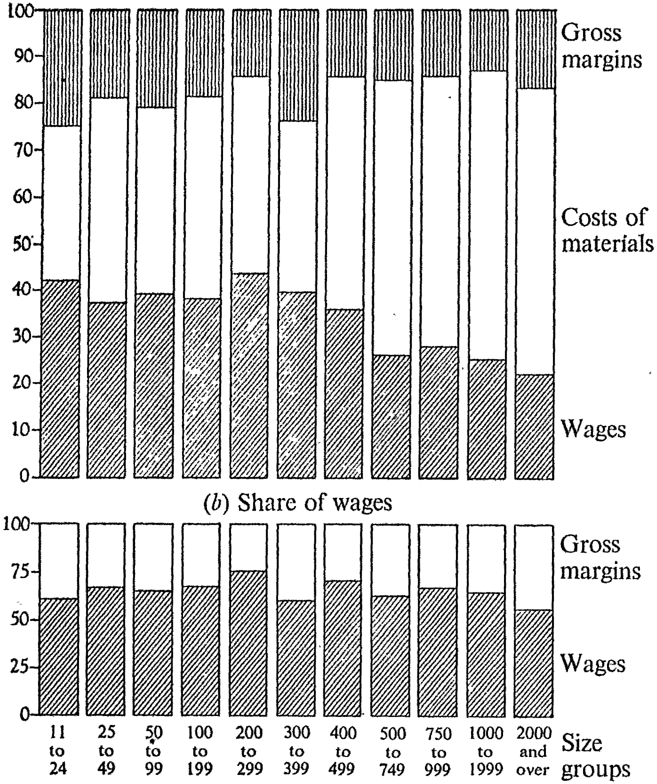
(28) WALLPAPER



(29) COPPER and BRASS



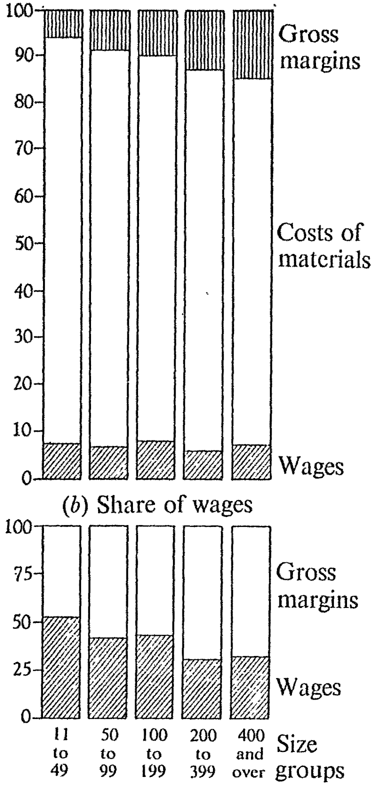
(30) SHIPBUILDING



(*a*) Cost structure

(*b*) Share of wages

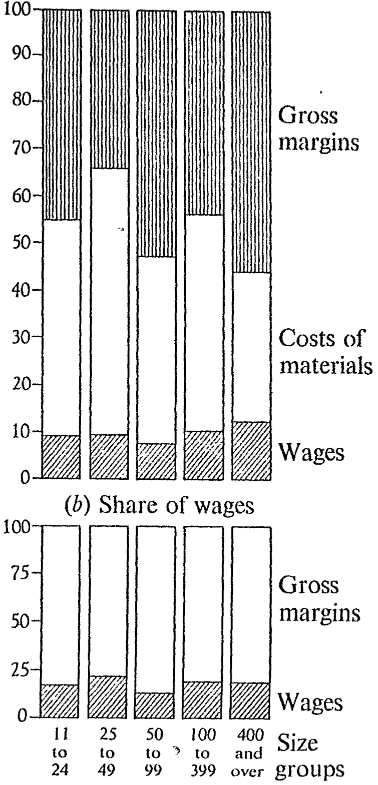
(31) SEED CRUSHING



(*a*) Cost structure

(*b*) Share of wages

(32) STARCH and POLISHES

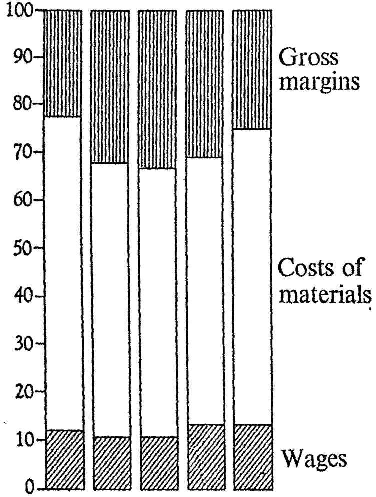


(*a*) Cost structure

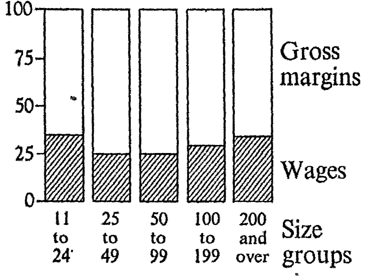
(*b*) Share of wages

(33) FERTILIZERS

(*a*) Cost structure

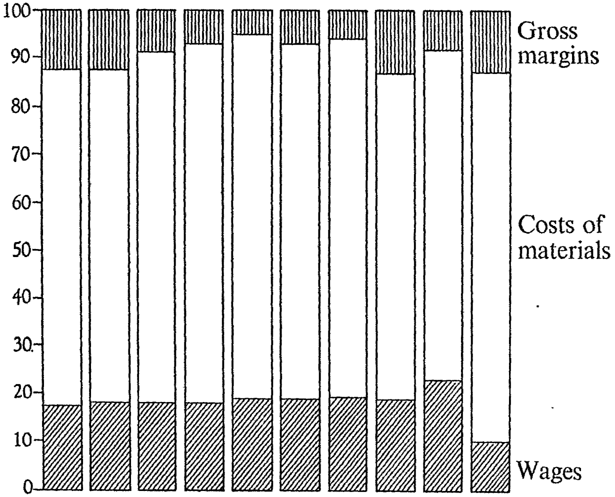


(*b*) Share of wages

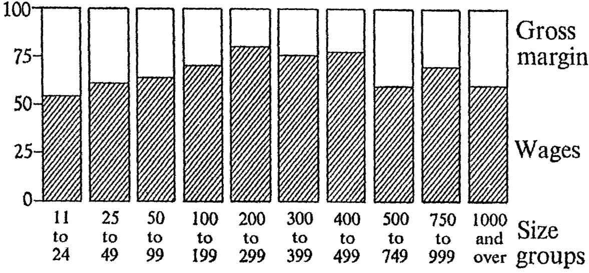


(34) COTTON SPINNING

(*a*) Cost structure

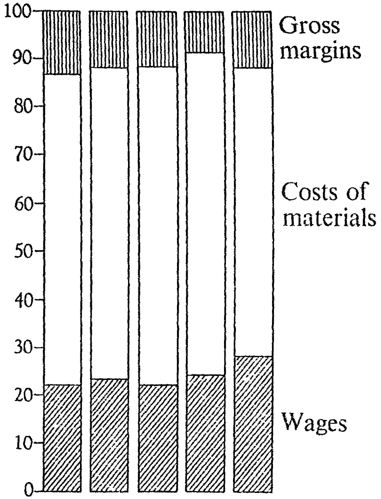


(*b*) Share of wages

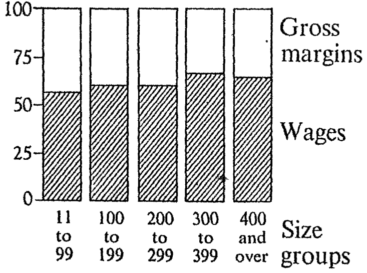


(35) JUTE

(*a*) Cost structure

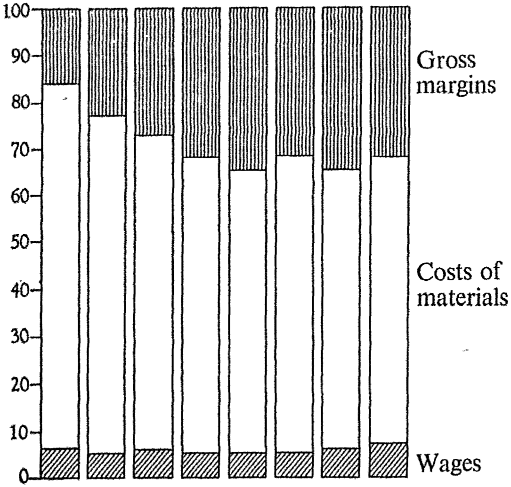


(*b*) Share of wages

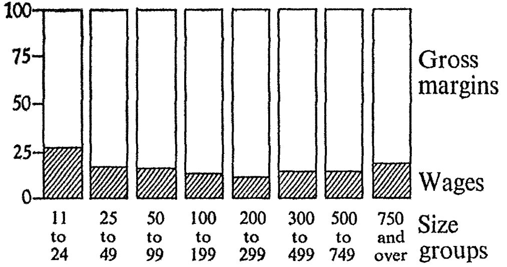


(36) BREWERIES

(a) Cost structure

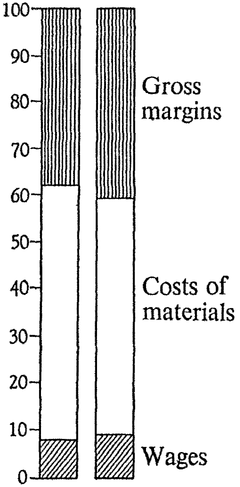


(b) Share of wages

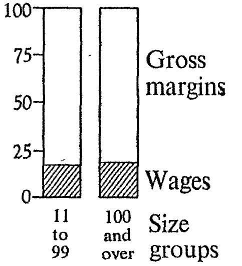


(37) SPIRIT DISTILLING

(a) Cost structure

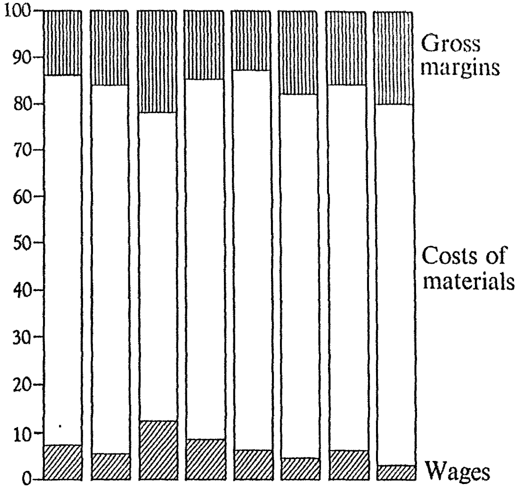


(b) Share of wages

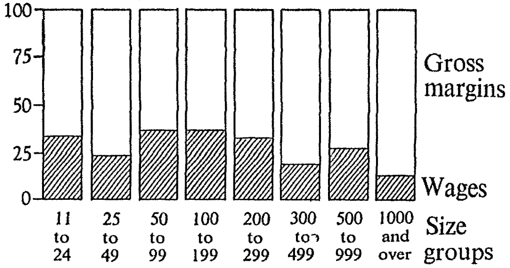


(38) TOBACCO

(a) Cost structure

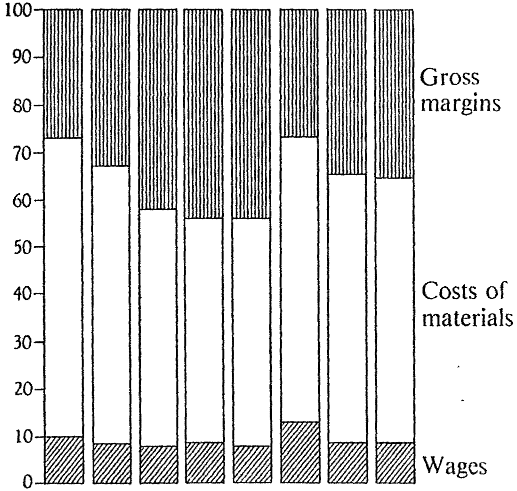


(b) Share of wages

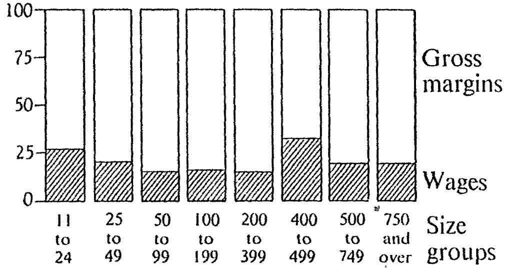


(39) SOAP

(*a*) Cost structure

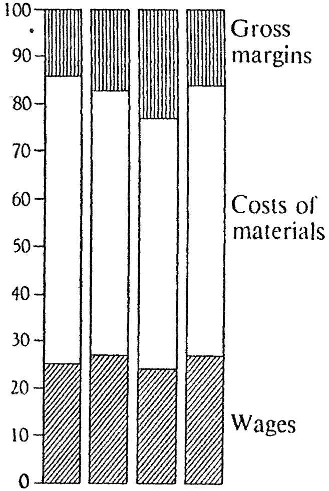


(*b*) Share of wages

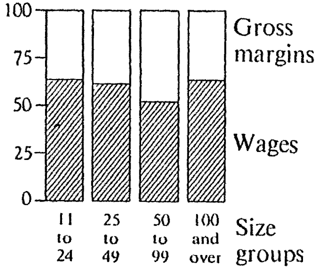


(40) GLOVES

(*a*) Cost structure



(*b*) Share of wages



GROUP III CHARTS

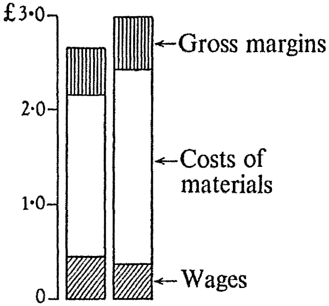
(*a*) Elements of costs per unit of output in different size groups

(*b*) Output per head in different size groups

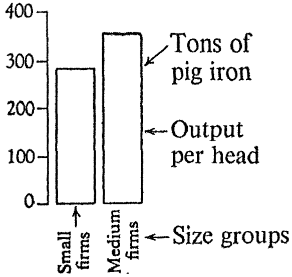
(41) PIG IRON

A. FORGE and FOUNDRY IRON

(*a*) Costs per unit of output

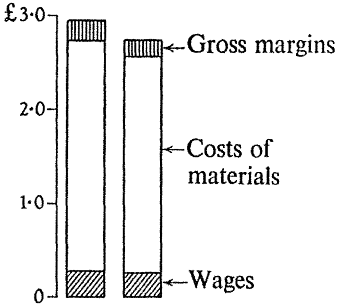


(*b*) Output per head

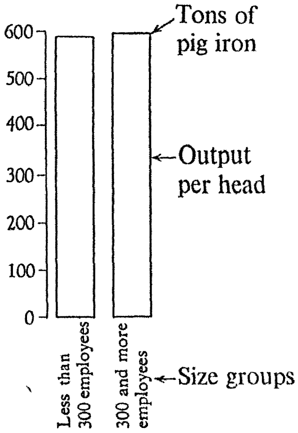


B. BASIC PIG IRON

(*a*) Costs per unit of output

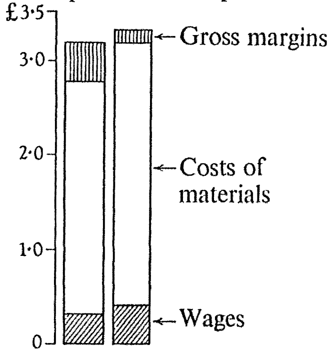


(*b*) Output per head

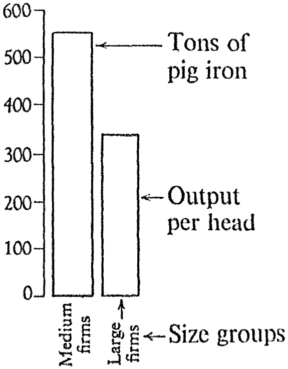


C. ACID PIG IRON

(*a*) Costs per unit of output

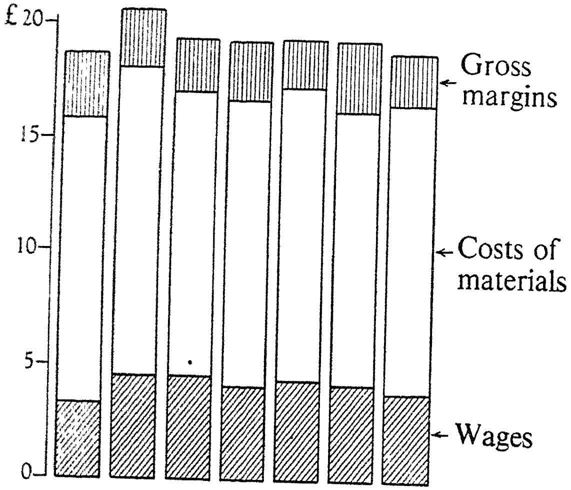


(*b*) Output per head

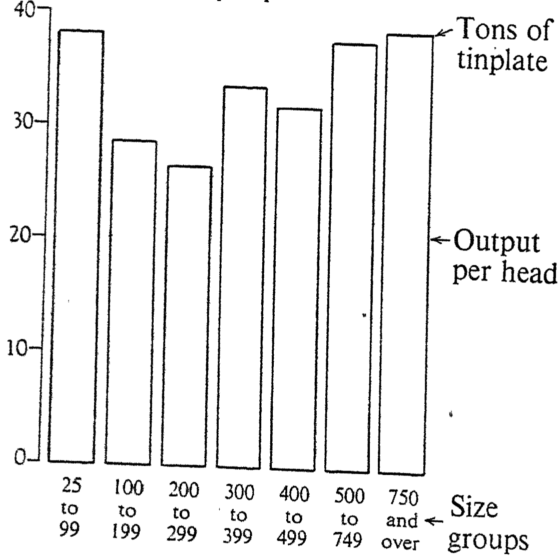


(42) TINPLATE

(*a*) Costs per unit of output

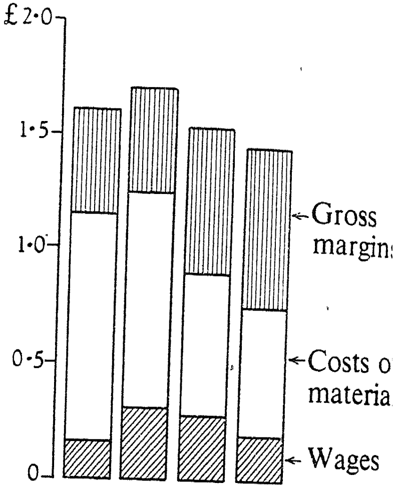


(*b*) Output per head

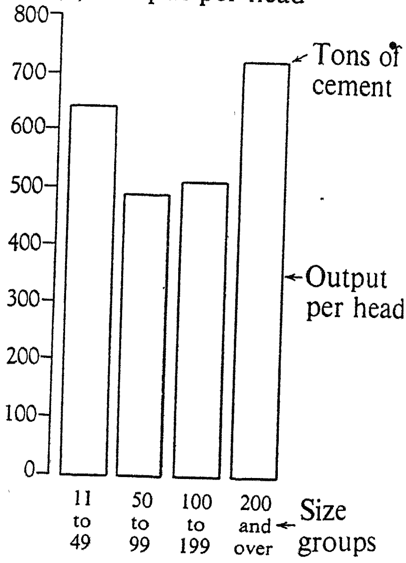


(43) CEMENT (Units)

(*a*) Costs per unit of output



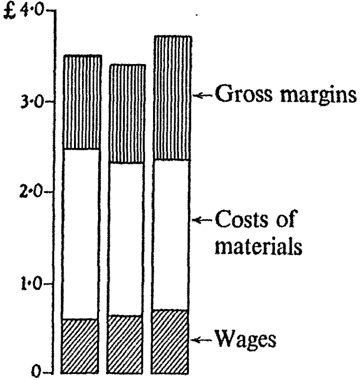
(*b*) Output per head



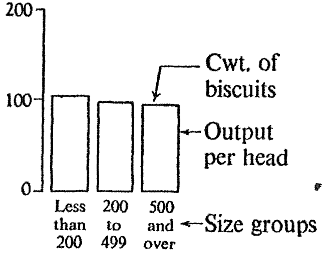
(44A) BISCUITS

Selling price £3 to £4

(*a*) Costs per unit of output



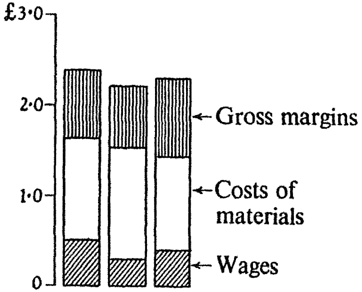
(*b*) Output per head



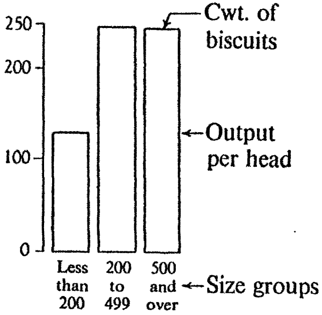
(44B) BISCUITS

Selling price £2 to £3

(*a*) Costs per unit of output

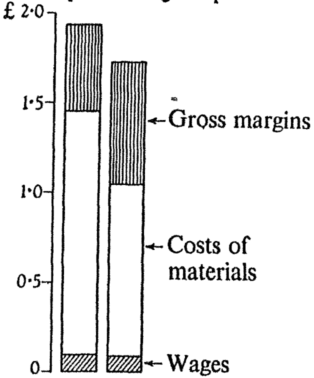


(*b*) Output per head

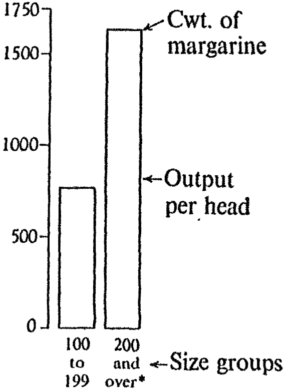


(45) MARGARINE

(*a*) Costs per unit of output



(*b*) Output per head

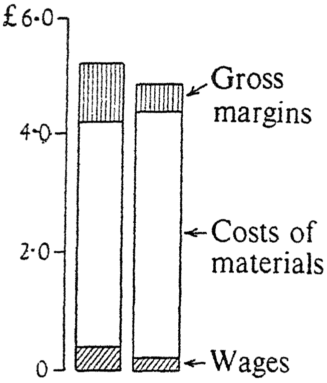


* The firms included in this size group have authorized the Board of Trade to supply for the purpose of the present enquiry the information which relates to this size group.

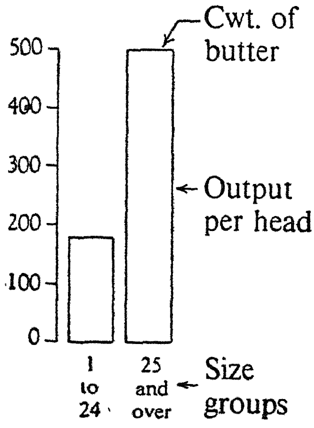
(46A) BUTTER

Creameries

(a) Costs per unit of output



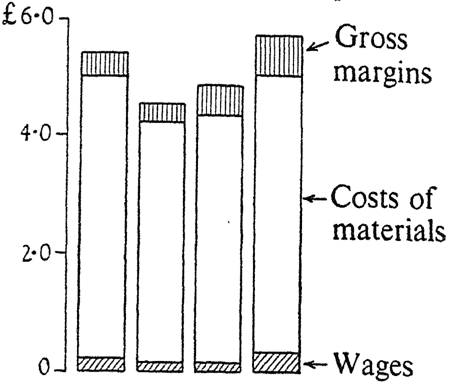
(b) Output per head



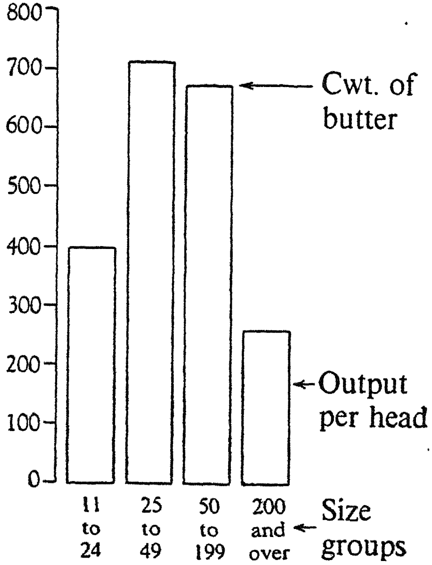
(46B) BUTTER

Blended butter producers

(a) Costs per unit of output



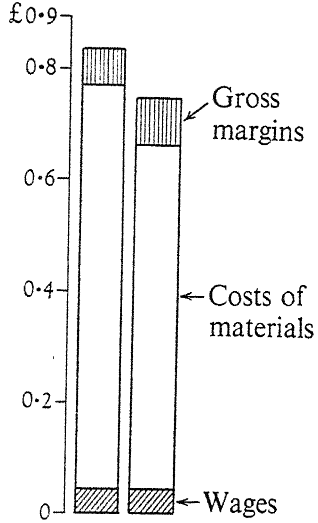
(b) Output per head



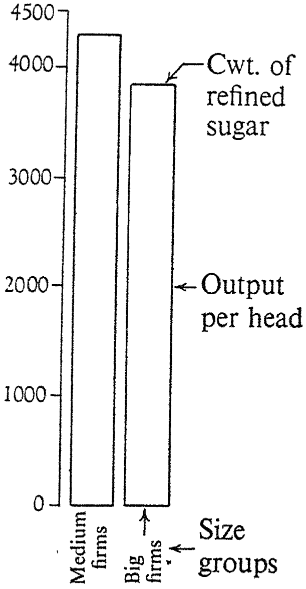
(47) SUGAR REFINERIES

Using other than home-grown beet

(*a*) Costs per unit of output

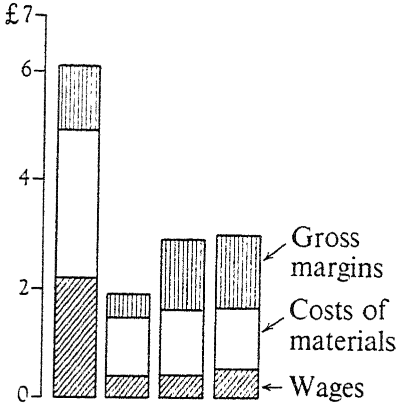


(*b*) Output per head

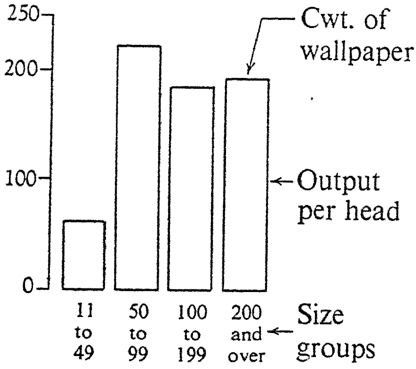


(48) WALLPAPER

(*a*) Costs per unit of output



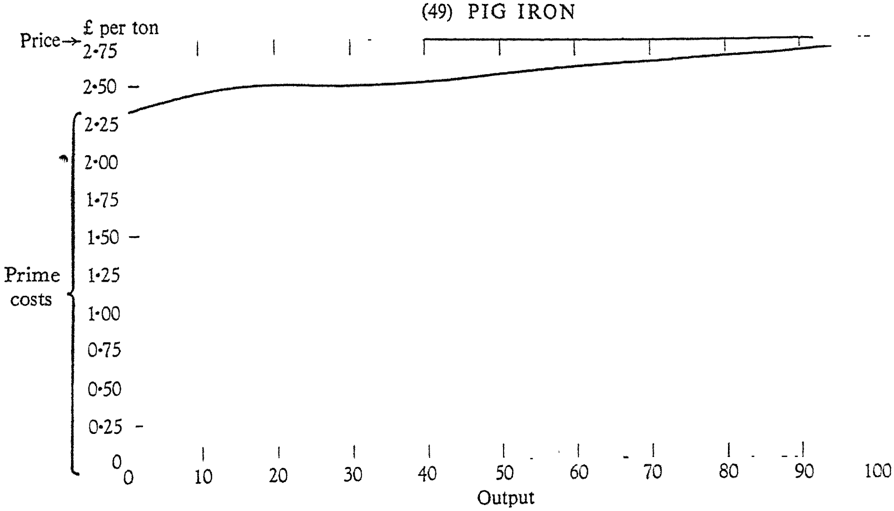
(*b*) Output per head



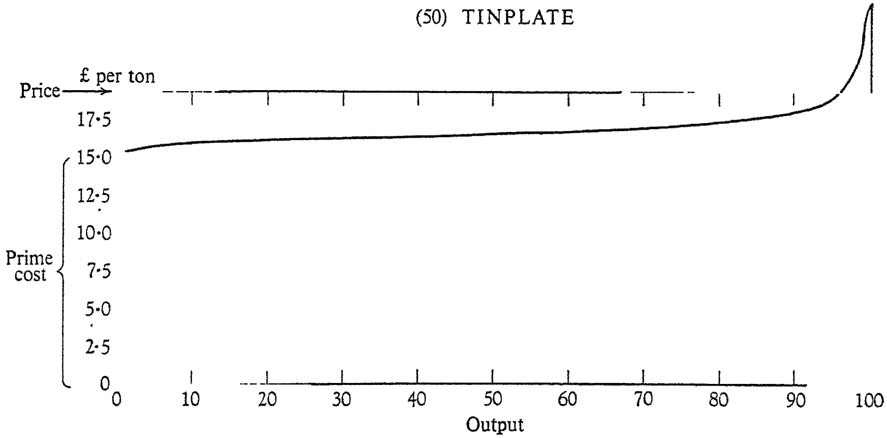
GROUP IV CHARTS

Prime cost curves for selected trades

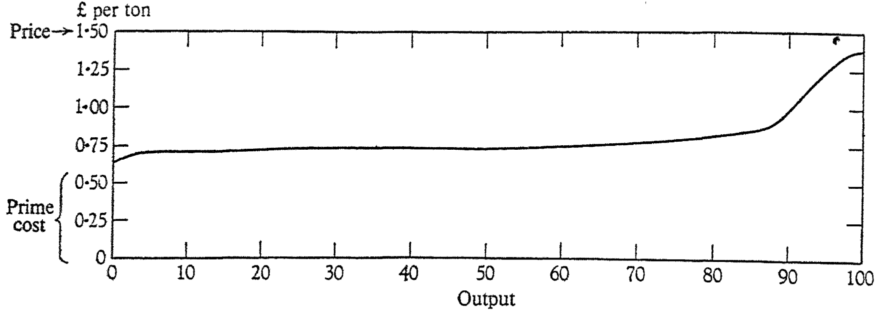
(49) PIG IRON



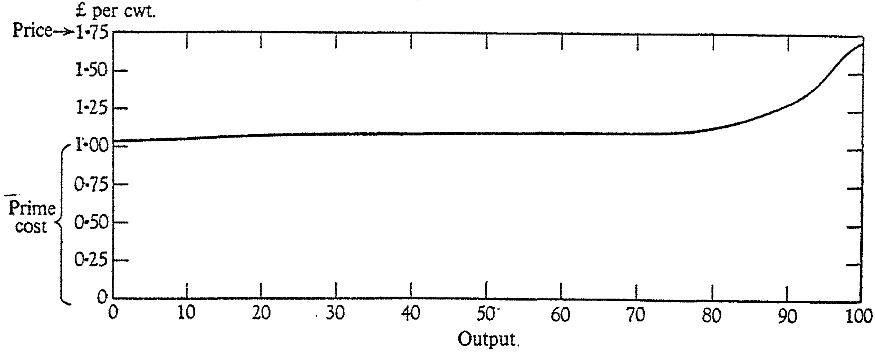
(50) TINPLATE



(51) CEMENT



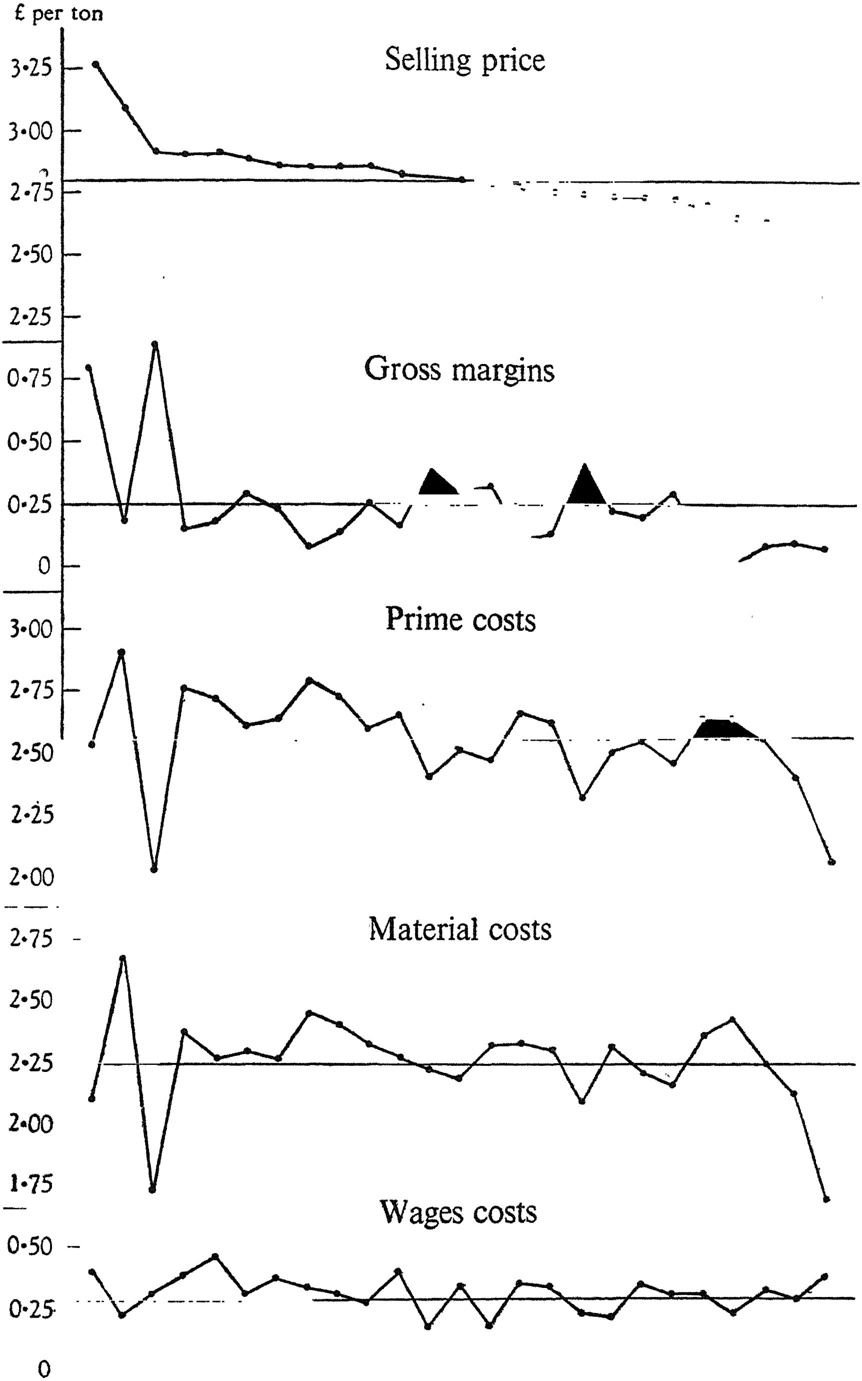
(52) MARGARINE



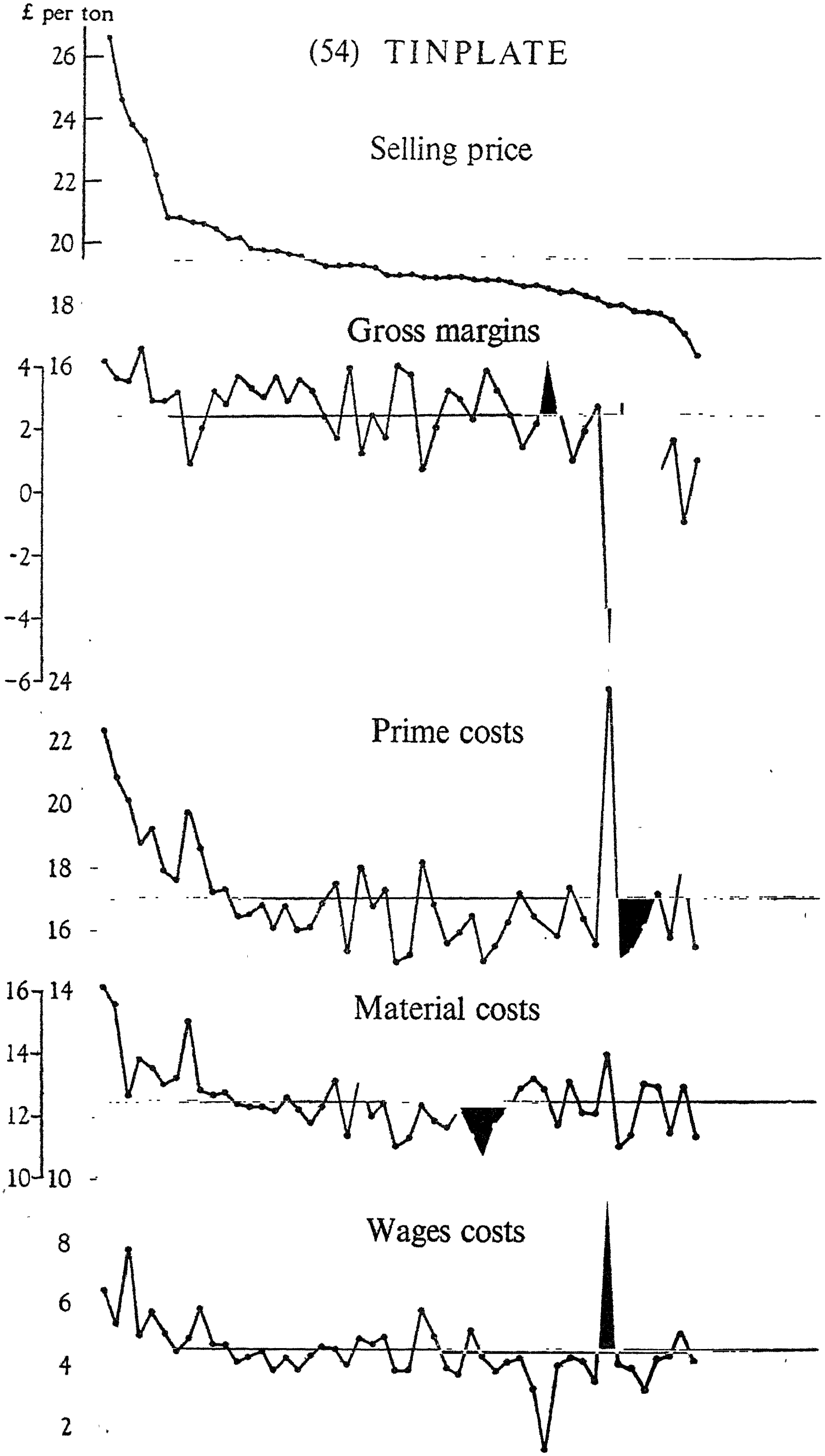
GROUP V CHARTS

Variations in price and in cost elements per unit of output between different firms

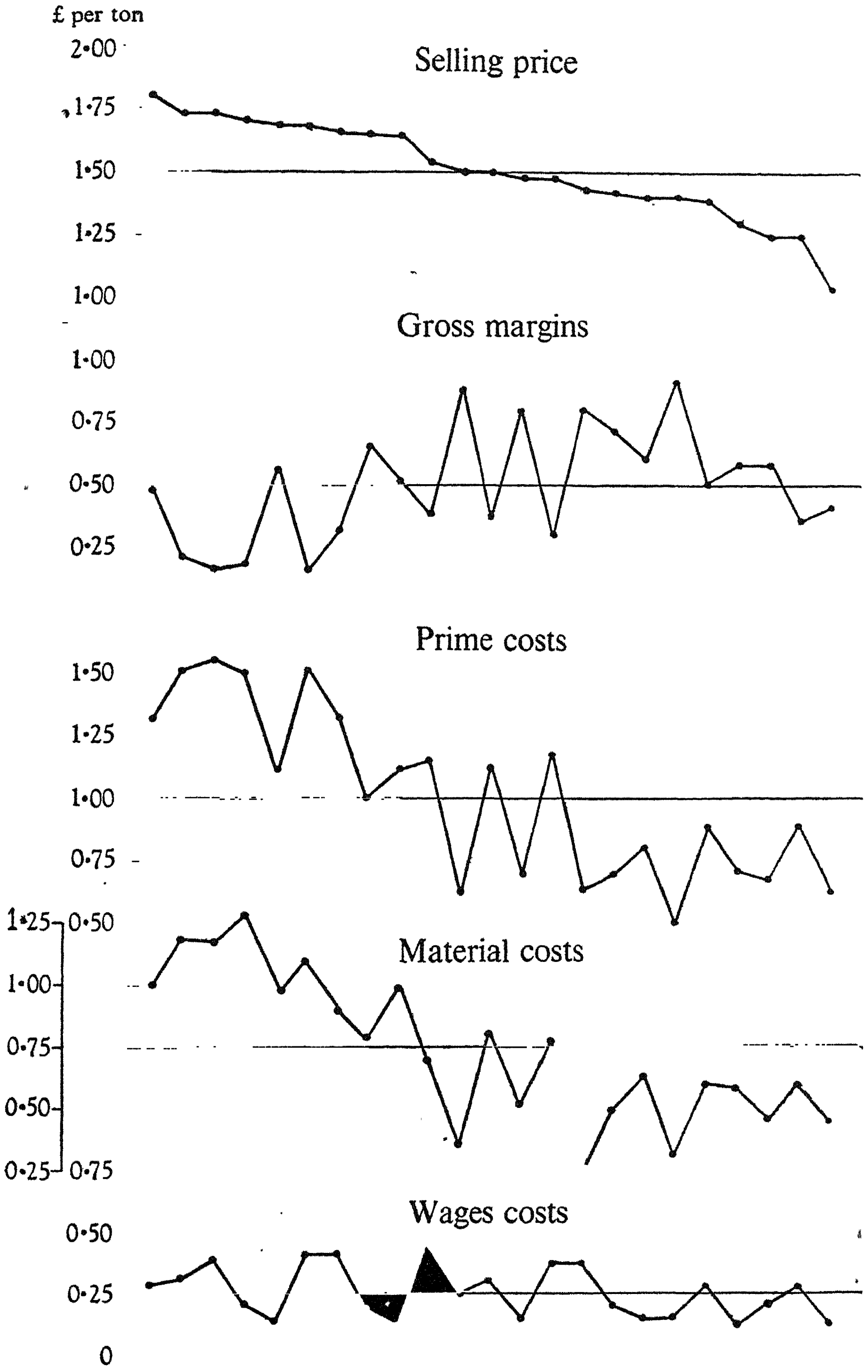
(53) PIG IRON


£ per ton
Selling price
3·25
3·00
2·75
2·50
2·25
Gross margins
0·75
0·50
0·25
0
Prime costs
3·00
2·75
2·50
2·25
2·00
Material costs
2·75
2·50
2·25
2·00
1·75
Wages costs
0·50
0·25
0

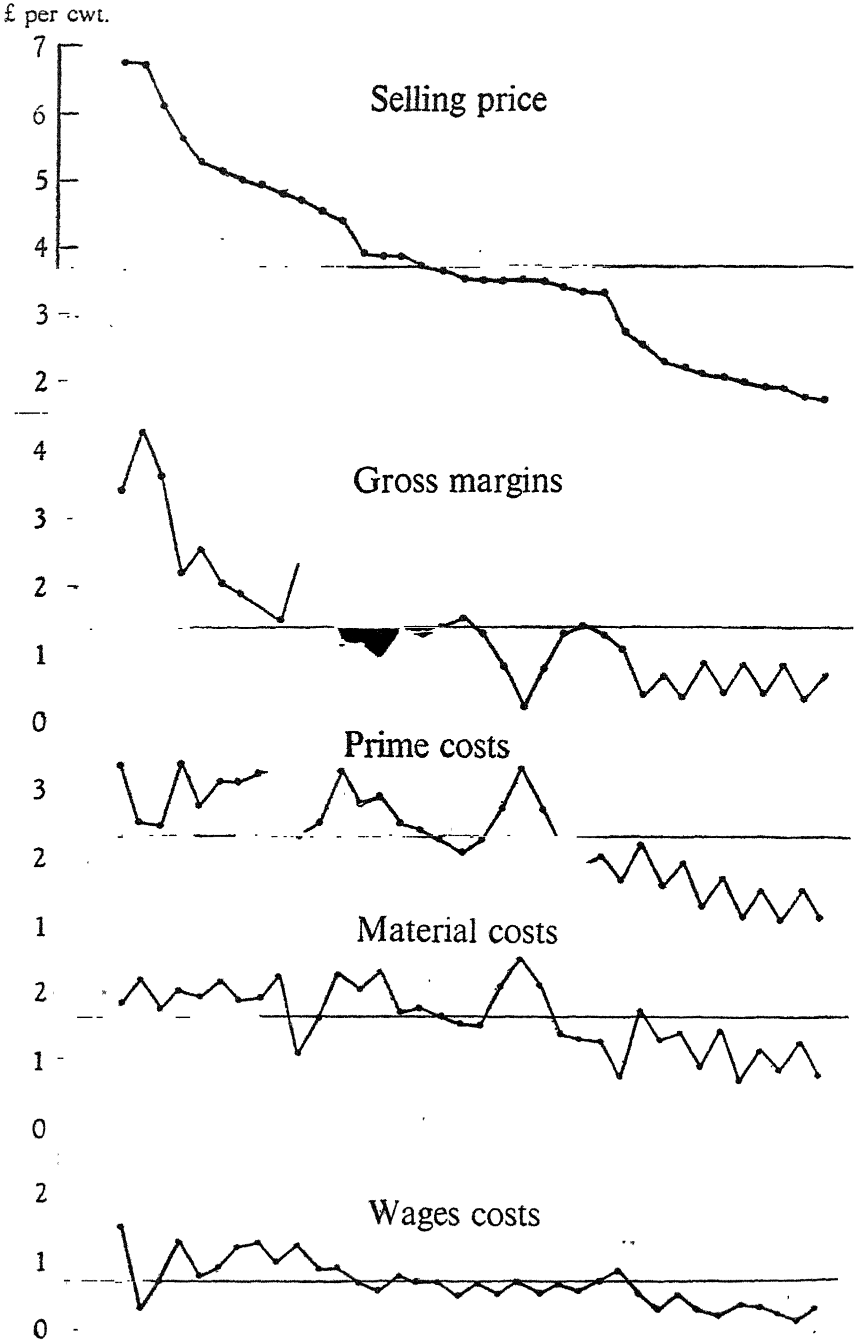
(54) TINPLATE


£ per ton
26
24
22
20
18
Selling price
Gross margins
4
2
0
-2
-4
-6
16
24
Prime costs
22
20
18
16
Material costs
16
14
12
10
14
10
Wages costs
8
6
4
2

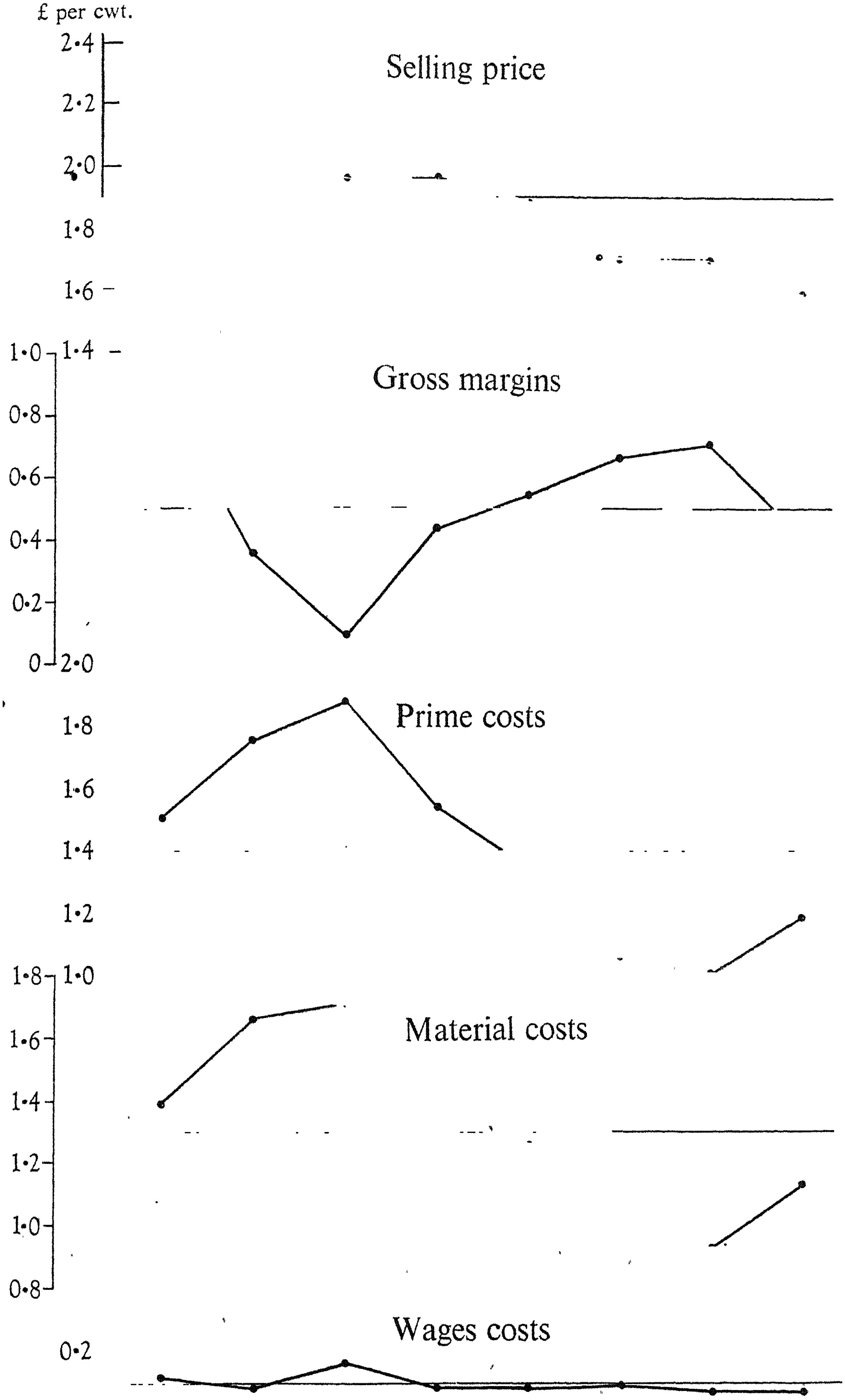
(55) CEMENT (Units)



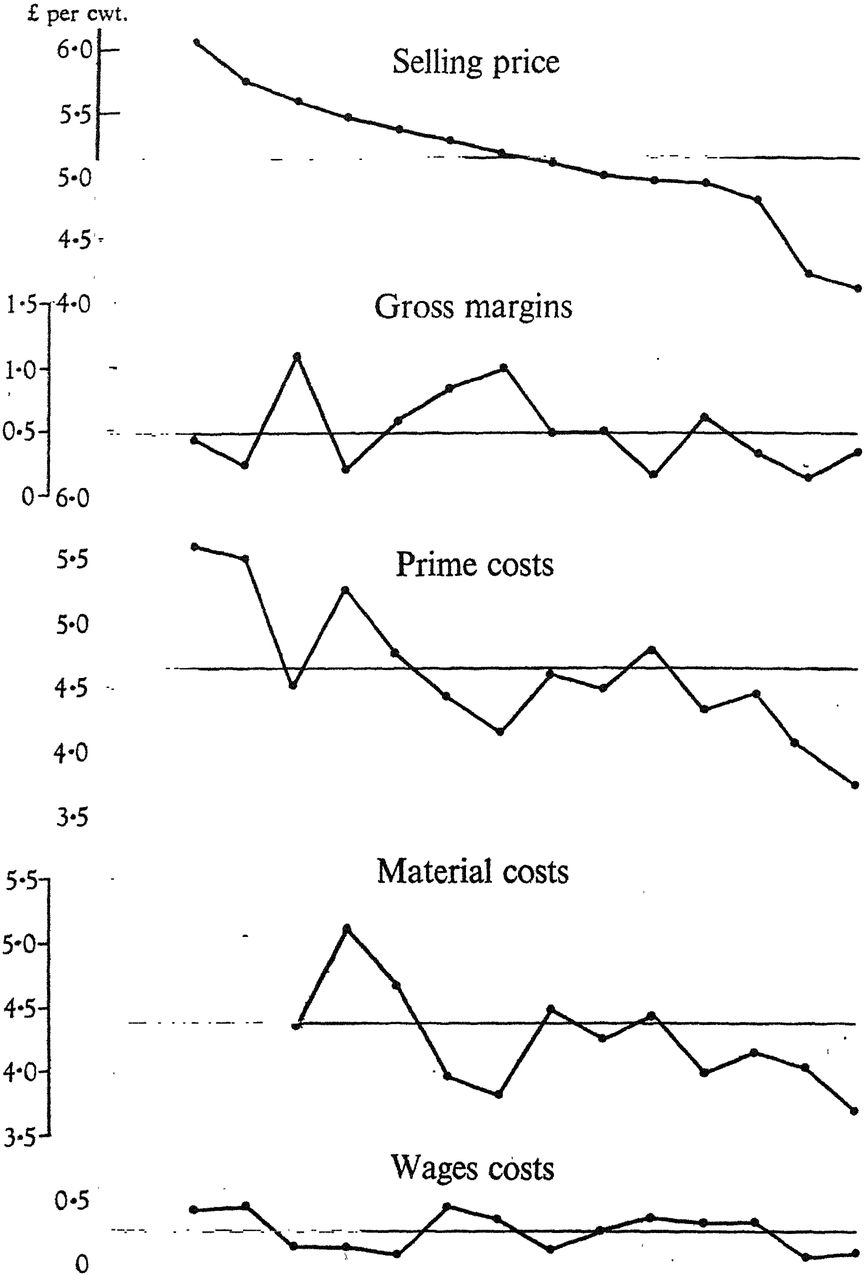
(56) BISCUITS


£ per cwt.
7
6
5
4
3
2
Selling price
4
3
2
1
0
Gross margins
Prime costs
3
2
1
Material costs
2
1
0
2
1
0
Wages costs

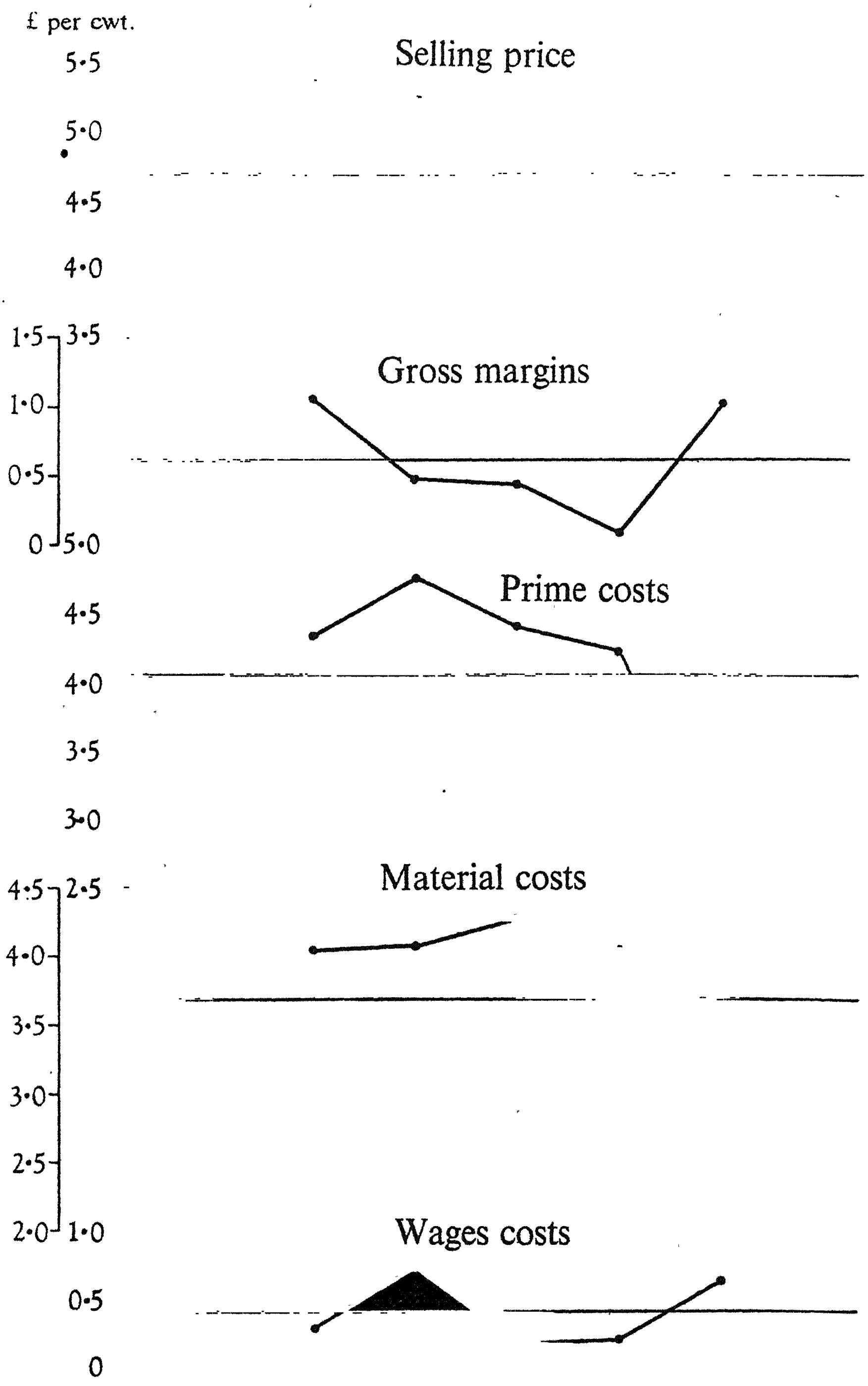
(57) MARGARINE



(58 A) BUTTER (Blended)

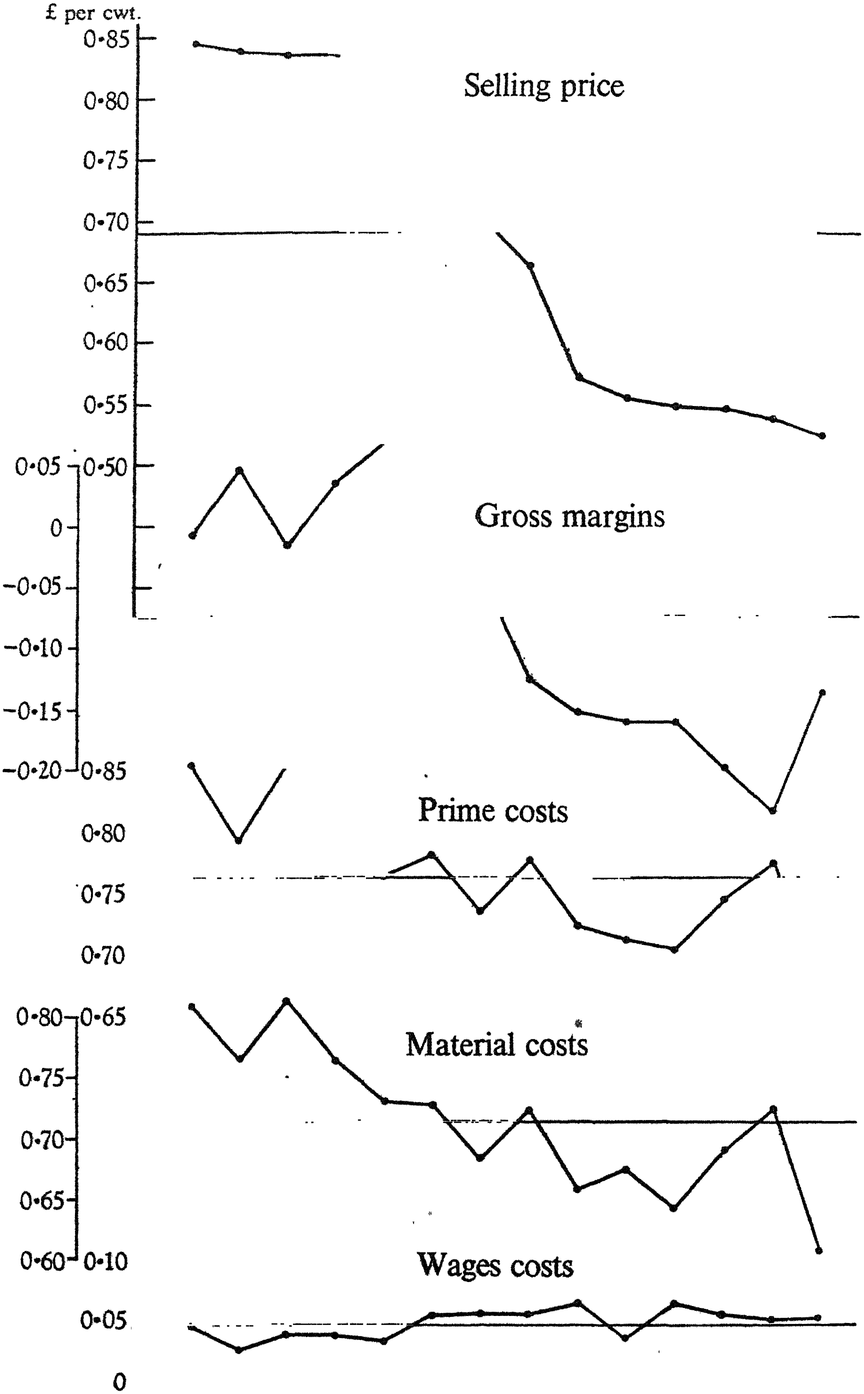


(58 B) BUTTER (Creameries)



(59) SUGAR

(Refined from home-grown sugar beet)



(60) WALLPAPER